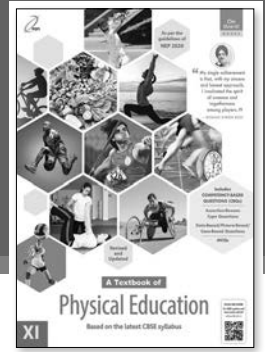


As per the
guidelines of
NEP 2020

— SUPPLEMENT —

A Textbook of Physical Education Class XI

Based on 2023–24 CBSE syllabus



1

Changing Trends and Careers in Physical Education

DEVELOPMENT OF PHYSICAL EDUCATION IN INDIA – POST INDEPENDENCE

Physical education has always been ingrained into the culture of education in Indian history. Almost every village had an *akhara* (a training hall). Physical fitness awareness (*chintan*) was considered as important as meditation (*dhyana*) and spiritualism (*aatmik*) for the fullest growth of the individual. After Independence, the subject began to assume more importance as a formal part of academics and was inculcated into the general curriculum. To understand how it reached its present status, we can have a thorough study of the various steps that were taken by the Indian Government with regard to the subject.

India made progress in all areas after gaining independence in 1947, including physical education, with the introduction of numerous schemes by the Government of India. In 1948, the Central Government Physical Education Committee, also known as the Tara Chand Committee, was established by the government. This committee recommended the establishment of the Central Institute of Physical Education

and Recreation and the improvement of sports standards in India.

Dr Tara Chand Committee 1948

Set-up under the chairmanship of eminent archaeologist and historian Dr Tara Chand to examine and improve physical education in India, the committee made the following recommendations:

1. to train teachers in physical education and its organisation, administration and recreation.
2. to institute a postgraduate course of one year.
3. to build training colleges, sports clubs, gymnasiums, and akharas in different parts of the country.

In 1950, the Central Advisory Board of Physical Education was established with the purpose of advising the government on physical education issues. One of the board's significant objectives was to make Physical Education a compulsory subject at the elementary, middle and senior secondary levels. To promote indigenous physical activities, the Central Advisory Board of Physical Education developed the National Plan of Physical Education and Recreation in 1956.

Central Advisory Board of Physical Education and Research 1950

Chaired by Dr Tara Chand, the board held its first meeting on 19 March, 1950, to outline recommendations on types of programmes and recreational games for youth, make suggestions for syllabi at primary, secondary and university levels and to fix standards for qualification for the selection of teachers in relation to physical education. The following contributions were made by the board:

1. The board suggested that the methods of training of physical education be made different for boys and girls.
2. Rules for designing the syllabi of certificate and diploma courses were outlined.
3. It laid down the minimum criteria of physical fitness for various age groups of students.
4. On the recommendation of the board, the central education ministry started scholarships in the field of physical education for leadership, training and research from 1950 onwards.
5. In 1951, the first Asian Games were held in Delhi and in 1953, the Health Minister of India, Rajkumari Amrit Kaur, introduced the Coaching Scheme for games and sports to streamline coaching programs in India since there were no professional coaching programs at that time. As a result, the National Institute of Sports (NIS) was established in 1961 at Moti Bagh, Patiala, Punjab, to produce qualified coaches in various sports.
6. The Central Advisory Board of Physical Education and Research itself was formally launched in 1954 to examine and execute the coordination of physical education programmes and activities across the country.

In 1954, the All India Council of Sports was established with the purpose of liaising between the Government and National Sports Federations to assist in financial matters. Under the All India Council of Sports, State Sports Council and District Sports Council were established.

All India Council of Sports 1954

All India Council of Sports was first constituted in 1954 by the Union Ministry of Education

on the advice of Maulana Abul Kalam Azad to bridge the gap between the various sports bodies of the country and the government. Its main objectives were:

1. to act as an advisory body to the government concerning all matters related to sports, including the preparation of financial assistance for sports bodies.
2. to start various training centres and build stadiums, gymnasiums, swimming pools, etc.
3. to advise on policies related to participation of Indian players in international competitions.
4. to advise on preventive measures for drug abuse and promotion of indigenous games.
5. to aid in the organisation of various sports competitions and guide the Ministry of Youth Affairs and Sports on matters referred specifically to it.

Ten years after gaining independence, in 1957, the Minister of Education and Culture, Government of India, established the first College of Physical Education, the Lakshmibai College of Physical Education (LCPE), in Gwalior, Madhya Pradesh. In 1973, the Lakshmibai College of Physical Education was renamed the Lakshmibai National College of Physical Education (LNCPE). In 1995, the LNCPE became the Lakshmibai National Institute of Physical Education (LNIPE) with the status of 'Deemed University' for the central government.

In 1958, the Ministry of Education established the Sports and Youth Welfare Department to promote physical education in India. The Ministry of Education sponsored the National Physical Efficiency Drive to evaluate the physical fitness status of people in India in 1959. The National Fitness Corps was established in 1965 with the objective of making the youth physically strong. In 1970–71, the Rural Sports tournament scheme was introduced by the government to involve rural youth and spot natural talent in various sports. The Sports Talent Search Scheme was launched in 1970–71 to promote sportspersons at the state and national levels. The National Sports Championship was started in 1975 to enhance women's participation in sports.

In 1982, the Asian Games were held in India, which provided a significant boost to sports

infrastructure and facilities. In 1984, the Sports Authority of India (SAI) was established under the Department of Sports to maintain and properly utilise the sports infrastructure built for the Asian Games. SAI has two objectives: to promote sports and achieve sports excellence at the national and international levels. In 1987, the Society for National Institutes of Physical Education and Sports (SNIPES) merged with the Sports Authority of India (SAI) to promote and develop sports awareness among people. The XIX Commonwealth Games 2010 were conducted in New Delhi. The National Education Policy 2020 also strongly emphasises including sports and physical education as a part of the curriculum.



Figure 1.1 In 2018, the CBSE launched Physical Education as a compulsory subject in class IX to XII, mainstreaming health and physical education.



EXERCISES

A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

- When was the Central Advisory Board of Physical Education established?
 - 1947
 - 1948
 - 1950**
 - 1956
- What was the objective of the Coaching Scheme introduced by Rajkumari Amrit Kaur?
 - To establish National Institute of Sports
 - To encourage Indian youth to participate in games and sports
 - To streamline coaching programs in India**
 - To liaison between Government and National Sports Federations
- Which event motivated Indian youth to participate in games and sports at the international level?
 - First College of Physical Education
 - National Physical Efficiency Drive
 - Asian Games**
 - Sports Talent Search Scheme
- What was the purpose of the Rural Sports tournament scheme introduced by the government?
 - To promote indigenous physical activities
 - To evaluate the physical fitness status of peoples in India
 - To involve rural youth and spot natural talent in different sports**
 - To enhance women participation in sports
- Where Lakshmbal National Institute of Physical Education (LNIPE) is situated?
 - New Delhi
 - Patiala
 - Bhubaneswar
 - Gwalior**
- Central Government Physical Education Committees was set-up in 1948, which is also known as?
 - Tara Chand Committee**
 - Rajkumari Amrit Kaur Committee
 - Tara Prasad Committee
 - NIS Committee

Note: Answers of all MCQs are highlighted in **bold**.

7. SAI Stands for

(a) Sports Appointment of India

(b) Sports Academic of India

(c) **Sports Authority of India**

(d) Sports Accreditation of India

B. Very Short Answer Type Questions

1. When was the National Institute of Sports (NIS) established?
2. What was the objective of the National Fitness Corps?
3. What was the objective of the Rural Sports tournament scheme?

C. Short Answer Type-I Questions

1. What was the purpose of the Central Advisory Board of Physical Education?
2. What was the objective of the Coaching Scheme introduced by Rajkumari Amrit Kaur?

D. Short Answer Type-II Questions

1. When and where was the first College of Physical Education established?
2. What was the objective of the National Plan of Physical Education and Recreation?
3. What was the objective of the National Sports championship for women?

E. Long Answer Type Question

1. Discuss the various initiatives taken by the Government of India to promote physical education and sports in India after independence.

2



Olympism Value Education

OLYMPIC VALUE EDUCATION – JOY OF EFFORT, FAIR PLAY, RESPECT FOR OTHERS, PURSUIT OF EXCELLENCE, BALANCE AMONG BODY, WILL AND MIND

The Olympic Values Education program is based on the philosophy that learning occurs through the balanced development of body and mind. It includes five educational values taken from the mental, emotional and physical domains of

learning: Joy of Effort, Fair Play, Respect for Others, Pursuit of Excellence, and Balance between Body, Will and Mind.

Joy of Effort

UNESCO recognises that physical education and sport are fundamental rights that guarantee the full development of one's personality. Therefore, it is crucial to promote physical activities that allow children to have fun and enjoy themselves. A forced or over-exerted approach to sports can lead to negative experiences and memories.

Fair Play

Fair play is not only a concept applicable in sports but also in different contexts of daily life. By playing by the rules, individuals can develop and reinforce fair play behaviour in their everyday activities. Participation in sports can instil the habit of fair play, which is reflected in an individual's attitude and behaviour towards their community. Fair play can be demonstrated through various means, such as shaking hands with opponents at the end of the game or appreciating extraordinary performances.

Respect for Others

According to the Olympic Charter, the goal is to educate youth through sports practiced in accordance with Olympism and its values to contribute to building a peaceful and better world. Accepting and respecting diversity is essential in a multicultural world. People should appreciate the worth of all cultures, regardless of race, age, gender and ability. Acceptance and respect for cultural differences can be achieved through sports, where individuals from diverse backgrounds come together to achieve one goal. Sports leaders and educators play a crucial role in promoting acceptance and respect for diversity.

Pursuit of Excellence

In today's competitive world, the focus is on striving to be the best. Pursuing excellence can lead young people to make positive, healthy choices and become the best version of themselves. Sports offer an opportunity for players to make healthy choices



Figure 2.1 Encourage children to engage in physical activities that are enjoyable and fun for them.

in a safe and social environment. A clean and safe community should prioritise the welfare of young people. Sports provide an environment free from discrimination, harassment and fear, where children and youth of all abilities can participate in physical activities.

Balance among Body, Will and Mind

The Olympic Movement extends beyond sports, embracing cultures, artistic works, environmental awareness and education. Pierre de Coubertin believed in a balanced approach to life, where learning occurred in the whole body, not just the mind. Physical learning took place in both the body and mind, but it could not be achieved without the will. Sports provide a medium for balancing body, will and mind.

EXERCISES



A. Objective Type/Multiple-Choice Questions

1. Multiple-Choice Questions:

1. According to the UNESCO Charter, what is the fundamental right of every human being?
(a) Access to education
(b) Access to healthcare
(c) **Access to physical education and sport**
(d) Access to food and water
2. Which of the following is not one of the core educational values of the Olympic Values Education?
(a) Joy of effort
(b) Fair play
(c) Respect for others
(d) **Freedom of choice**

and nerves, keeping the entire system in radiant health.

- ❖ By releasing physical and mental tension, a person liberates a vast amount of energy.

II. *Pranayamas*

- ❖ The yogic breathing practice known as Pranayamas revitalise the body and help to control the mind, leaving the person calm and refreshed.

III. *Relaxation*

- ❖ Relaxation helps control anxiety, hypertension, and other discomforts of the mind and body.

Five Approaches to Manage Healthy Lifestyle

Ahara (food and wellness)

- ❖ Emphasis on *mitahara* i.e. half filled with food, one-fourth with water and one-fourth with air, including proper quality of food and state of mind.

Vihara (recreation and wellness)

- ❖ Comprises relaxation, recreation, relationships and sound sleep.

Achara (right conduct)

- ❖ Includes right habits, attitude and behaviour for oneself and others.
- ❖ Yama and Niyama play an important role in better management of life.



Figure 3.1 The practice of yoga is renowned for promoting positive physical and mental health, as well as cultivating feelings of happiness and inner peace.

Vichara (right thinking)

- ❖ Helps in controlling the *virttis* (thoughts/modifications) of the mind and thereby giving positive directions to the negative thoughts.

Vyavahara (right behaviour)

- ❖ Actions must be performed with a sense of detachment and duty.
- ❖ Right behaviour towards self and others is also a key to a healthy lifestyle.

Yogic concept considers health as a holistic way and sees the person as a whole. By practicing yoga regularly, one can lead an active lifestyle and effectively manage stress.



EXERCISES

A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

1. What is stress according to medical science?
 - (a) **A specific response of the body to nonspecific demands**
 - (b) A mental illness
 - (c) A physical ailment
 - (d) A result of external factors
2. What does Yoga consider as a holistic way of health?
 - (a) Only physical well-being
 - (b) Only mental well-being
 - (c) **Both physical and mental well-being**
 - (d) Spiritual well-being

3. What is the Yogic concept of Ahara?

(a) Right conduct

(c) **Food and wellness**

(b) Right thinking

(d) Recreation and wellness

B. Very Short Answer Type Questions

1. What are the physical signs of an overworked body?

2. What are the five approaches to manage a healthy lifestyle according to the Yogic concept?

C. Short Answer Type-I Questions

1. What does Yoga align?

2. What does relaxation help control?

D. Short Answer Type-II Questions

1. What are the three components of Vihara?

2. What is the Yogic breathing practice that revitalises the body and helps to control the mind?

E. Long Answer Type Question

1. Explain how Yoga helps in stress management.

4



Physical Education and Sports for Children With Special Needs

DISABILITY ETIQUETTES

The word etiquette means acceptable behaviour in society with good manners and code of conduct. Disability etiquette does not have separate code of conducts; it is simply the way in which you can make a person with special needs comfortable in her/his own world. Though it is easy to assume that people with special needs may need our help all the time, it isn't true. Before extending aid, their consent should be obtained first. We need not show excessive concern as such gestures might inadvertently cause offense. The way we speak to

them, the way we establish physical contact, the way we show them empathy or encouragement – all these should be conducted with sensitivity. What they actually require from us is to be treated as normally as we would treat non-disabled persons. Since every person is different and imbued with different feeling so her/his likes and dislikes will also be different. People with different kinds of impairment will certainly have a different type of mind-set but the rules to deal with them remain the same as generally we deal with anyone in the society.

Some common etiquettes which may help to

develop a better understanding with differently abled person are given below:

1. The first step in showing disability etiquette is in the use of language. Terms such as 'handicapped', 'retarded', 'physically challenged', 'spastic', 'wheelchair-bound', 'cripple', 'psycho', 'mentally challenged', 'abnormal', 'the blind', 'dwarf', 'midget', 'epileptic', 'the deaf/dumb/mute', 'invalid', etc. are outdated and should not be used while addressing persons with disabilities. Rather, we should use 'person with blindness/blind person/visually impaired person', 'disabled person', 'person who uses wheelchair', 'person with epilepsy', 'person of short stature', etc. In the same manner, 'able-bodied' should be replaced by 'non-disabled'.
2. The tone of our voice and our manners while speaking are just as important as the words we use. We should speak as normally as possible without being patronising or overly polite. Even if the differently abled person has an interpreter with her/him, we should speak directly to his/her.
3. We should not use sign language. A handshake will do just fine as a greeting.
4. We should ask short questions to persons with speech impairment rather than long explanations. We should also listen patiently without correcting them or interrupting while speaking.
5. We should never patronise people who use wheelchairs by patting them on their head or



Figure 4.1 We should always behave normally with differently abled people.

- shoulder. It is also considered rude to lean or hang on to the wheelchair.
6. When talking to people who use wheelchairs or crutches, we should keep ourselves at eye level and not look down at them.
 7. While introducing ourselves to people with visual impairment, we should identify ourselves and others who are with us.
 8. In order to get the attention of a person with hearing impairment, we should tap them on the shoulder or wave, and look at them directly while communicating.
 9. We should not ask differently abled persons personal questions unless they want to open up on their own.
 10. We should give differently abled persons additional time to communicate what they wish without losing our patience. If we don't understand what they are trying to say, we should also not pretend to understand them.

EXERCISES



A. Objective Type/Multiple-Choice Questions

1. Multiple-Choice Questions:

1. What is the meaning of etiquette with regards to CWSN?
 - (a) Code of conduct for disabled people
 - (b) **Acceptable behaviour in society with good manners and code of conduct**
 - (c) Rules for physical contact with disabled people
 - (d) None of these

2. What should we do before extending aid to a person with special needs?
 - (a) Assume they need our help
 - (b) **Get their consent**
 - (c) Show excessive concern
 - (d) None of these
3. What is the first step in showing disability etiquette?
 - (a) Speaking in sign language
 - (b) Using outdated terms like 'handicapped' and 'retarded'
 - (c) **Using language like 'person with blindness/blind person/visually impaired person'**
 - (d) None of these

B. Very Short Answer Type Questions

1. What does disability etiquette mean?
2. What should we do while speaking to a person with speech impairment?

C. Short Answer Type-I Questions

1. What are some outdated terms that should not be used while addressing persons with disabilities?
2. How should we introduce ourselves to people with visual impairment?

D. Short Answer Type-II Questions

1. Why should we not use sign language while talking to a person with speech impairment?
2. What should we do while talking to people who use wheelchairs or crutches?

E. Long Answer Type Question

1. Explain the importance of sensitivity in disability etiquette.

5



Physical Fitness, Wellness and Lifestyle

LEADERSHIP THROUGH PHYSICAL ACTIVITY AND SPORTS

Physical education is a field which involves a lot of physical activity and sports. It is a very active and dynamic field. It is evident that various professional domains use the component of physical education, physical activity and sports to train their professionals to become leaders. So,

it is true that involvement in physical education activities itself is a process of creating a leader. Physical education provides a platform to young students to nurture their innate potential. All the qualities which are required to become a leader are directly or indirectly inculcated during physical education activities. Through physical education one becomes creative in one's thoughts and develops new ideas. One develops a strong willpower and

15–20 minutes. It reduces bleeding, swelling and pain by decreasing blood circulation. On small areas, apply ice packs for 5 minutes and on large areas for 20 minutes. Repeat it 4–8 times daily. It should not last more than 20 minutes so as to avoid nerve damage or frostbite. If there is loss of sensation or discolouration in areas other than the area being iced, it is a sign that the application is no longer safe and should be stopped instantly. Applying ice for too long makes the area red instead of pale after removing it.

- ❖ **Compression:** After the application of ice, wrap the injury starting from the furthest injured part to the main injured part by using an elastic bandage or compression strap. A firm pad may be placed underneath the wrap over the injury. It reduces pain and swelling. Compression should be firm enough but comfortable. If there

is pain or a tingling sensation, it indicates that the wrap is too tight and can hinder recovery or cause damage. Do not wrap the entire limb.

- ❖ **Elevation:** To reduce swelling and recurrence of swelling, elevate the injured part (upper or lower limb) above heart level using pillows. This sends excess fluids back to the blood vessel system to prevent swelling.

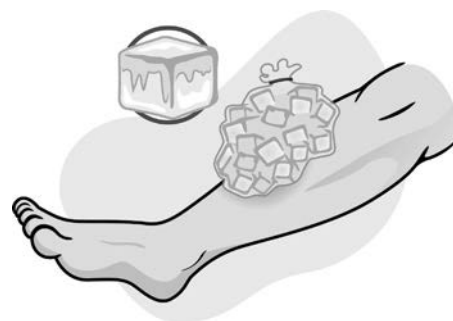


Figure 5.3 Ice packs reduce bleeding and pain.

EXERCISES



A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

1. What qualities required to become a leader are directly or indirectly inculcated during physical education activities?
 - (a) **Creativity, sense of discipline, dedication and devotion**
 - (b) Knowledge of professional domains
 - (c) Understanding of advanced technologies
 - (d) Awareness of global issues
2. What is best understood through sporting activities?
 - (a) Intellectual and reasoning skills
 - (b) Social bondings and cooperation
 - (c) **Goal setting, training, hardship, struggle and success**
 - (d) Modesty and humility
3. What is the primary aim of first aid?

(a) Prevent further harm	(b) Promote recovery
(c) Preserve life	(d) All of these
4. What does the acronym PRICE stand for?

(a) Protect, Restore, Instruct, Cure, Energize	(b) Prevention, Rest, Ice, Compression, Elevation
(c) Protection, Rest, Ice, Compression, Elevation	(d) Preservation, Recovery, Ice, Compression, Education

5. How long should ice be applied on an injury according to the PRICE procedure?
 - (a) 5–10 minutes
 - (b) 10–15 minutes
 - (c) **15–20 minutes**
 - (d) 20–25 minutes
6. What is the purpose of compression in the PRICE procedure?
 - (a) To reduce bleeding
 - (b) **To reduce pain and swelling**
 - (c) To promote recovery
 - (d) All of these
7. What should be done if there is loss of sensation or discoloration in areas other than the area being iced?
 - (a) Continue applying ice
 - (b) **Remove ice immediately**
 - (c) Increase the duration of ice application
 - (d) None of these

B. Very Short Answer Type Questions

1. What is First Aid?
2. What are the three aims and objectives of first aid?

C. Short Answer Type-I Questions

1. What is the PRICE procedure? Explain each component briefly.
2. How does physical education and sporting activity help in developing leadership qualities?

D. Short Answer Type-II Questions

1. What is the primary aim of first aid? Explain briefly.
2. What are the three Ps of first aid? Explain each briefly.

E. Long Answer Type Questions

1. How does physical education activities prepare individuals to become leaders and provide a platform to nurture their potential?
2. How does the PRICE procedure help in the initial treatment of injuries? Explain each component in detail.



6

Test, Measurement and Evaluation

IMPORTANCE OF TEST, MEASUREMENT AND EVALUATION IN SPORTS

When it comes to sports and physical education,

working with quantifiable data is inarguably an essential part of the entire process of growth and success. Numerical values let us see at a glance how much progress a sportsperson has made, how

much is left to develop, and what limitations should be imposed. As for the teachers and trainers, they are helped by tests and measurements in evaluating the requirements of the training regime so that they can plan for more successful outputs in a cohesive and effective manner.

We can understand the importance of tests, measurements and evaluations in the field of sports and physical education from the following points:

1. **Classification of Athletes:** Not all sportspersons share the same physical aptitude and attributes – a fact that has to be taken into account while putting individual athletes in the appropriate categories. For instance, in boxing there are separate weight categories. Classification is usually done on the basis of sex, height, age, weight, motor abilities, tests and measurements, and mental and psychological capacities. It is done by experts who have an acute knowledge of the matter.
2. **Identification of Skill Sets:** Tests, measurements and evaluations can help trainers identify an athlete's physical and technical qualities and direct them in the right sporting area best suited for their potential.
3. **Improvement of Performance:** Growth has a linear progression, and both can only be attained if both the athlete and the trainer are aware of how much the athlete has improved. Tests, measurements and evaluations should thus be conducted and examined to discover the progress and weaknesses of the athlete. They should also enable the trainers to redesign the programmes for more effective results.
4. **Motivation:** Tests, measurements and evaluations motivate sportspersons – from aspiring students to adult professionals – by setting and showing records of the levels of their achievements against their own previous standards, as well as the standards of others, for competitive purposes.
5. **Goal Setting:** Tests, measurements and evaluations help in setting goals for the students which involves using mental skills such as imagery which in turn can help with skill learning, strategies, presentation and working through competitive anxiety.

6. **To Predict Performance Potential:** Using the results achieved through tests, measurements and evaluations, the performance potential of an athlete can be predicted in advance. It enables the trainers to adopt a fair and efficient selection process.
7. **For Finding Out Athletes' Needs:** A training can only be effective when the students' needs are discovered and addressed. Fulfilling these needs will empower them both physically and mentally, and push them towards greater achievements.
8. **For Research Purposes:** With proper research and experimentation, there can be significant development in the field of physical education and sports. Tests, measurements and evaluations contribute data to help researchers develop new techniques, bring further improvement and predict performance in the field of physical education.

CALCULATION OF BMI, WAIST-HIP RATIO, SKINFOLD MEASUREMENT (3-SITE)

Calculation of Body Mass Index (BMI)

Body Mass Index (BMI) is a statistical measurement which uses an individual's height and weight for comparison so that their health can be determined. It was invented by Adolphe Quetelet, and is also sometimes known as Quetelet Index. It should be noted that BMI is not an actual measurement



Figure 6.1 The weight and height of a person are needed for BMI calculation.

Table 6.1 Body Mass Index (BMI) Table for Adults

Obese (>30) Overweight (25–29.9) Normal (18.5–24.9) Underweight (<18.5)

HEIGHT in feet/inches and centimetres

Weight (kg)	4'8"	4'9"	4'10"	4'11"	5'0"	5'1"	5'2"	5'3"	5'4"	5'5"	5'6"	5'7"	5'8"	5'9"	5'10"	5'11"	6'0"	6'1"	6'2"	6'3"	6'4"	6'5"
	142cm	147	150	152	155	157	160	163	165	168	170	173	175	178	180	183	185	188	191	193	196	
(117.9)	58	56	54	53	51	49	48	46	45	43	42	41	40	38	37	36	35	34	33	32	32	31
(115.7)	57	55	53	51	50	48	47	45	44	42	41	40	39	38	37	36	35	34	33	32	31	30
(113.4)	56	54	52	50	49	47	46	44	43	42	40	39	38	37	36	35	34	33	32	31	30	30
(111.1)	55	53	51	49	48	46	45	43	42	41	40	38	37	36	35	34	33	32	31	31	30	29
(108.9)	54	52	50	48	47	45	44	43	41	40	39	38	36	35	34	33	33	32	31	30	29	28
(106.6)	53	51	49	47	46	44	43	42	40	39	38	37	36	35	34	33	32	31	30	29	29	28
(104.3)	52	50	48	46	45	43	42	41	39	38	37	36	35	34	33	32	31	30	30	29	28	27
(102.1)	50	49	47	45	44	43	41	40	39	37	36	35	34	33	32	31	31	30	29	28	27	27
(99.8)	49	48	46	44	43	42	40	39	38	37	36	34	33	32	32	31	30	29	28	27	27	26
(97.5)	48	47	45	43	42	41	39	38	37	36	35	34	33	32	31	30	29	28	28	27	26	25
(95.3)	47	45	44	42	41	40	38	37	36	35	34	33	32	31	30	29	28	28	27	26	26	25
(93.0)	46	44	43	41	40	39	37	36	35	34	33	32	31	30	29	29	28	27	26	26	25	24
(90.7)	45	43	42	40	39	38	37	35	34	33	32	31	30	30	29	28	27	26	26	25	24	24
(88.5)	44	42	41	39	38	37	36	35	33	32	31	31	30	29	28	27	26	26	25	24	24	23
(86.2)	43	41	40	38	37	36	35	34	33	32	31	30	29	28	27	26	26	25	24	24	23	23
(83.9)	41	40	39	37	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	23	22
(81.6)	40	39	38	36	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21
(79.4)	39	38	37	35	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21
(77.1)	38	37	36	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20
(74.8)	37	36	34	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	20
(72.6)	36	35	33	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	21	20	19	19
(70.3)	35	34	32	31	30	29	28	27	27	26	25	24	24	23	22	22	21	20	20	19	19	18
(68.0)	34	32	31	30	29	28	27	27	26	25	24	23	23	22	22	21	20	20	19	19	18	18
(65.8)	33	31	30	29	28	27	27	26	25	24	23	23	22	21	21	20	20	19	19	18	18	17
(63.5)	31	30	29	28	27	26	26	25	24	23	23	22	21	21	20	20	19	18	18	17	17	17
(61.2)	30	29	28	27	26	26	25	24	23	22	22	21	21	20	19	19	18	18	17	17	16	16
(59.0)	29	28	27	26	25	25	24	23	22	22	21	20	20	19	19	18	18	17	17	16	16	15
(56.7)	28	27	26	25	24	24	23	22	21	21	20	20	19	18	18	17	17	16	16	16	15	15
(54.4)	27	26	25	24	23	23	22	21	21	20	19	19	18	18	17	17	16	16	15	15	15	14
(52.2)	26	25	24	23	22	22	21	20	20	19	19	18	17	17	16	16	16	15	15	14	14	14
(49.9)	25	24	23	22	21	21	20	19	19	18	18	17	17	16	16	15	15	15	14	14	13	13
(47.6)	24	23	22	21	21	20	19	19	18	17	17	16	16	16	15	15	14	14	13	13	13	12
(45.4)	22	22	21	20	20	19	18	18	17	17	16	16	15	15	14	14	14	13	13	12	12	12
(43.1)	21	21	20	19	19	18	17	17	16	16	15	15	14	14	14	13	13	13	12	12	12	11
(40.8)	20	19	19	18	18	17	16	16	15	15	15	14	14	13	13	13	12	12	12	11	11	11
(38.6)	19	18	18	17	17	16	16	15	15	14	14	13	13	13	12	12	12	11	11	11	10	10
(36.3)	18	17	17	16	16	15	15	14	14	13	13	13	12	12	11	11	11	11	10	10	10	9

of body fat percentage; rather, BMI aims to show how much body weight a person has in relation to their height, which can further demonstrate if their weight is excessive for their stature, or lacking. BMI thus helps in finding our ideal weight.

BMI can be easily measured and evaluated. Through BMI, we can know where we stand on the weight range – that is, if we are underweight, overweight, obese, or if we have normal weight. Its value is measured in kg/m².

How to Calculate BMI

BMI can be calculated using the following formula:

$$\text{Body Mass Index (BMI)} = \frac{\text{Body weight}}{\text{Height} \times \text{Height}}$$

In this formula, the weight of an individual is measured in kilograms and the height in metres. Let us use an example so that we can clearly understand the concept.

Person (A) has a weight of 60 kg, and a height of 1.65 m. That means:

$$A\text{'s BMI} = \frac{60 \text{ kg}}{1.65 \text{ m} \times 1.65 \text{ m}} = 22.03 \text{ kg/m}^2$$

This is just the first step of analysing our health using BMI. The World Health Organisation (WHO) has given a chart for determining health status using weight through BMI results.

Table 6.2 BMI Chart

Category	BMI
Underweight	BMI < 18.5
Ideal	BMI = 18.5 – 24.9
Overweight	BMI = 25 – 29.9
Obesity Class I	BMI = 30 – 34.9
Obesity Class II	BMI = 35 – 39.9
Extreme obesity	BMI > 40

Since A's BMI is 22, A has an ideal weight for his height.

Calculation of Waist–Hip Ratio (WHR)

Waist-hip ratio is the measurement of the waist

circumference divided by hip circumference. For example, if an individual's waist measures 30 inches and the hips measure 42 inches, his waist-hip ratio is 0.71. If a male's WHR is greater than 1.00, then he is at health risk. Similarly, if a female's WHR is more than 0.85, then she is at health risk. WHR can thus be used to assess the risk levels of a person's health with respect to heart diseases, hypertension and type-II diabetes. According to scientific research, those with more weight around the waist (also called 'apple-shaped body') are at greater health risk than people with more weight distributed at the hips ('pear-shaped body'). Therefore the relative weight between the two body regions is a useful tool for examining one's own health status.

How to Calculate WHR

WHR is a simple measure that can be taken at home by anyone. It can be calculated by measuring the circumferences (girth) of the waist (just above the belly button) and hips (at the widest part of the buttocks) using a measuring tape. The measurements are then used to calculate WHR as shown in the formula below:

$$\text{WHR} = \frac{\text{Waist circumference}}{\text{Hip circumference}}$$

Measurements are taken in inches or centimetres. It is usually used to determine the coronary artery disease risk factor associated with obesity.

Both BMI and WHR should be taken together for a more accurate determination of health risk.

According to the WHO, a healthy WHR is 0.9 or less for men and 0.85 or less for women. For men and women both, if WHR is more than 1.0 or higher, there are higher chances of heart diseases and other conditions that are linked to being overweight.



Art Integration

Prepare a BMI chart with images to represent various BMI scores through pictures of people with their food and lifestyle habits.

Skinfolds Measurement

This is a manual technique of measuring the body

composition. In this technique, the superficial lower fold of the skin is picked up without piercing and the thickness of the picked skin is measured with the help of a skinfold calliper as shown in the figure. The skinfold measurements are being taken from various sites of the body like – biceps, triceps, forearms, sub scapularies, suprailliac region, inner thigh, calf and so on. The measurement should be taken from at least three sites.



Figure 6.2 Measurement of skinfold

The sum of the skinfold measurements is then tallied with the norms (see Tables 6.3 and 6.4). This is an approximate method because the reading depends upon the mastery of the person taking the skinfold measurements.

Table 6.3 Skinfold measurement chart (Men)

Measurement – Reading in Millimetres

Age	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-21	22-23	24-25	26-27	28-29	30-31	32-33	34-35
UP TO 20	2.0	3.9	6.2	8.5	10.5	12.5	14.3	16.0	17.5	18.9	20.2	21.3	22.3	23.1	23.8	24.3	24.9
21-25	2.5	4.9	7.3	9.5	11.6	13.6	15.4	17.0	18.6	20.0	21.2	22.3	23.3	24.2	24.9	25.4	25.8
26-30	3.5	6.0	8.4	10.6	12.7	14.6	16.4	18.1	19.6	21.0	22.3	23.4	24.4	25.2	25.9	26.5	26.9
31-35	4.5	7.1	9.4	11.7	13.7	15.7	17.5	19.2	20.7	22.1	23.4	24.5	25.5	26.3	27.0	27.5	28.0
36-40	5.6	8.1	10.5	12.7	14.8	16.8	18.6	20.2	21.8	23.2	24.4	25.6	26.5	27.4	28.1	28.6	29.0
41-45	6.7	9.2	11.5	13.8	15.9	17.8	19.6	21.3	22.8	24.7	25.5	26.6	27.6	28.4	29.1	29.7	30.1
46-50	7.7	10.2	12.6	14.8	16.9	18.9	20.7	22.4	23.9	25.3	26.6	27.7	28.7	29.5	30.2	30.7	31.2
51-55	8.8	11.3	13.7	15.9	18.0	20.0	21.8	23.4	25.0	26.4	27.6	28.7	29.7	30.6	31.2	31.8	32.2
56&Up	9.9	12.4	14.7	17.0	19.1	21.0	22.8	24.5	26.0	27.4	28.7	29.8	30.8	31.6	32.3	32.9	33.3
<div style="display: flex; justify-content: space-between;"> LEAN IDEAL AVERAGE OVERFAT </div>																	

Note: For measurements over 36 mm: Add 0.25% for every millimetre pinched above 36 mm

Table 6.4 Skinfold measurement chart (Women)

Measurement – Reading in Millimetres

Age	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-21	22-23	24-25	26-27	28-29	30-31	32-33	34-35
UP TO 20	11.3	13.5	15.7	17.7	19.7	21.5	23.2	24.8	26.3	27.7	29.0	30.2	31.3	32.3	33.1	33.9	34.6
21-25	11.9	14.2	16.3	18.4	20.3	22.1	23.8	25.5	27.0	28.4	29.6	30.8	31.9	32.9	33.8	34.5	35.2
26-30	12.5	14.8	16.9	19.0	20.9	22.7	24.5	26.1	27.6	29.0	30.3	31.5	32.5	33.5	34.4	35.2	35.8
31-35	13.2	15.4	17.6	19.6	21.5	23.4	25.1	26.7	28.2	29.6	30.9	32.1	33.2	34.1	35.0	35.8	36.4
36-40	13.8	16.0	18.2	20.2	22.2	24.0	25.7	27.3	28.8	30.2	31.5	32.7	33.8	34.8	35.6	36.4	37.0
41-45	14.4	16.7	18.8	20.8	22.8	24.6	26.3	27.9	29.4	30.8	32.1	33.3	34.4	35.4	36.3	37.0	37.7
46-50	15.0	17.3	19.4	21.5	23.4	25.2	26.9	28.6	30.1	31.5	32.8	34.0	35.0	36.0	36.9	37.6	38.3
51-55	15.6	17.9	20.0	22.1	24.0	25.9	27.6	29.2	30.7	32.1	33.4	34.6	35.6	36.6	37.5	38.3	38.9
56&Up	16.3	18.5	20.7	22.7	24.6	26.5	28.2	29.8	31.3	32.7	34.0	35.2	36.3	37.2	38.1	38.9	39.5
<div style="display: flex; justify-content: space-between;"> LEAN IDEAL AVERAGE OVERFAT </div>																	

Note: For measurements over 36 mm: Add 0.25% for every millimetre pinched above 36 mm

SOMATOTYPES (ENDOMORPHY, MESOMORPHY AND ECTOMORPHY)

Although the number of people inhabiting the earth runs into billions, no two persons have the same physique and physical features – not even identical twins. The differences may be seen in height, weight, distribution of weight, bone structure, muscular build, skin type, etc. Classification of body types is therefore not an easy task as variations outnumber similarities.

Experts have, however, managed to come up with practical methods of body type – somatotype – classifications, which have also proven useful in the field of physical education and sports. Somatotype (or body type) is the present shape and composition of a human body.

There are three somatypes currently used: *endomorph*, *mesomorph* and *ectomorph*. They were classified by W H Sheldon.

Endomorphy

1. Endomorphs are characterised by a soft and round body shape with short arms, legs and neck. They have a wide bone structure and their body fat is distributed mainly on the arms and thighs. The upper halves of the arms and legs are thicker than the lower halves.
2. Endomorphs usually find it difficult to lose weight and are at greater risk of becoming obese as their metabolism is slower and thus capacity of fat storage is higher than other body types.
3. Their muscles are underdeveloped and hidden



Figure 6.3 Cardio workouts

under layers of fat. This can be corrected with the help of exercise, although it must be noted that endomorphs have to work harder than most as they may gain weight shortly after giving up exercise. For this reason, regular exercise is recommended.

4. They are prone to knee and feet problems and have a low centre of gravity.
5. As sports require agility and muscular strength, endomorphs, with their low energy levels, are not best suited for sports that require a lot of endurance, speed and exertion.
6. This does not mean that endomorphs should completely give up on their hopes. With a disciplined exercise regime and balanced diet, they can also participate in sports such as badminton, martial arts, field events like discus and hammer throw, tennis, swimming, power-lifting, etc.
7. Suggested dieting tips for endomorphs are inclusion of high density foods such as almonds and avocado, and breaking up of calories into smaller meals taken at frequent intervals rather than eating large amounts of food in each meal.
8. Endomorphs should not engage in heavy cardio workouts and they should take longer rests between exercise breaks.

Mesomorphy

1. Mesomorphs are lean and muscular with a flat abdomen. Their shoulders are broad, their arms and legs are proportionate and their bones and



Figure 6.4 Mesomorphs are suitable for powersports like football.

muscles are thick. Mesomorphy body type is often referred to as 'athletic build'.

- Mesomorphs are able to build muscles quickly and with greater ease. Their body fat is low and evenly distributed, although this will change for the worse if they do not exercise. They also burn fat quickly.
- Mesomorphs have strong and agile bodies, good metabolism and respond well to exercise – attributes that fit the physiology of a sports person.
- Mesomorphs can do strong cardio workouts, unlike endomorphs, and apply themselves to all types of powersports – weightlifting, bodybuilding, football, hockey, etc.

Ectomorphy

- Tall and slender, ectomorphs have narrow shoulders and hips, flat chests and elongated limbs and muscles. Their joints are small.
- They have low fat content which is responsible for their thin and fragile appearance and they find it difficult to gain weight and muscle mass due to fast metabolism.
- An ectomorph's diet should be rich in calories and fat. However, it should be supplemented by cardio workouts and strength training exercise routines.
- Sports suitable for ectomorphs include badminton, tennis, table tennis, gymnastics, track and field and so on.

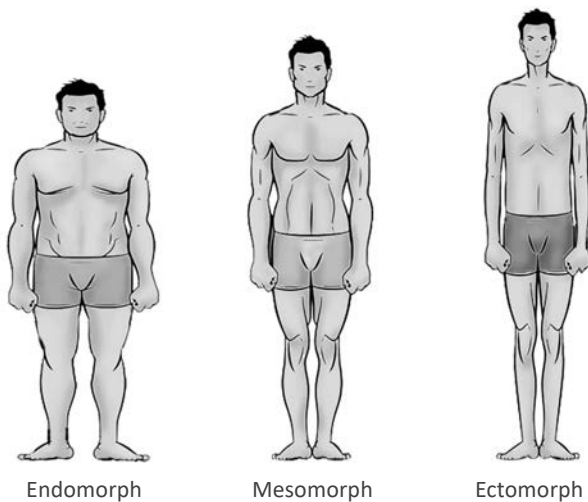


Figure 6.5 Somatotypes of individuals

Measuring Somatotype

- Heath-Carter measurement system is used for finding out the somatotype of a person. It includes ratings for all three somatotypes discussed previously and using a range of anthropometric measurements in its calculation.
- An individual is classified on a scale of 1 to 7 in each category, with 1 being the minimum rating and 7 being the maximum.
- The three ratings together give a somatotype number, with endomorphy being the first score, followed by mesomorphy and ectomorphy.
- Scores are plotted in a shield diagram, also known as a somatography, which represents the somatotype of the individual on a two-dimensional scale.
- It can be said that all individuals have some combination of all three somatotypes to a certain degree. If an individual has a score of 361 on the somatograph, it indicates that they are a mesomorph since 6 is a higher score than 3 or 1.
- By using the results of a somatograph, athletes can be matched with suitable sports types. For example, a statistic of 375 is suitable for a footballer and 172 for a bodybuilder.

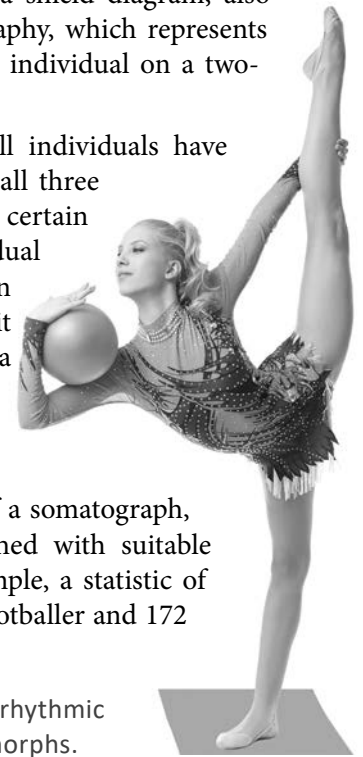


Figure 6.6 Generally rhythmic gymnasts are ectomorphs.

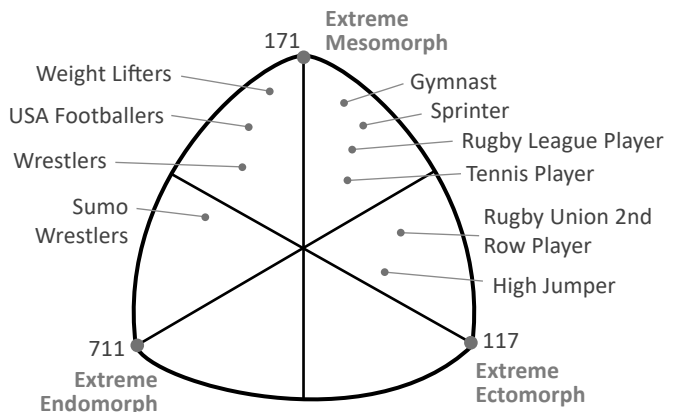


Figure 6.7 Somatotype or body type chart



Extension Activity

Assess yourself on various grounds to identify your somatotype. Repeat the same exercise with your friend or sibling.

MEASUREMENT OF HEALTH-RELATED FITNESS

The fitness components that are directly related to health or, in other words, whose imbalance will create an ill-effect in the maintenance of good health, are termed as Health-Related Fitness Components. Few of them are listed below:

- ❖ Cardiorespiratory endurance
- ❖ Muscular strength
- ❖ Muscular endurance
- ❖ Flexibility
- ❖ Body composition

Further, we will learn about a health-related physical fitness test battery for Indian school children between age group of 9 and 18 years. These test batteries are developed by Fit India Mission in 2019. Earlier items of AAHPER health related physical fitness test were conducted to measure various fitness components. Let us discuss these health related fitness tests developed by the Fit India Mission.

Table 6.5

Health Related Fitness Components	Test Items
1. Body Composition	BMI
2. Muscular Strength and Endurance	Partial Curl-up and Push-up
3. Flexibility	Sit and Reach Test
4. Cardiovascular Endurance	600 M Run/Walk

BMI (Body Composition)

Body composition is a physiological characteristic that affects the individual's capacity of doing daily activity. In other words, the productivity of human body performance depends directly upon the composition of the body. It is the ratio of the muscle/protein mass and the fat content of the body. Body size such as height, length

and circumference are also grouped under this component. The test performed is BMI, which is calculated from body Weight (W) and height (H). $BMI = W / (H \times H)$, where W = body weight in kilograms and H = height in meters. The higher the score usually indicates higher levels of body fat.

Procedure:

Equipment: Stadiometer

How to Measure Height

1. Stand straight with heels together. Remove shoes or any heavy clothes. Keep arms normally by the side.
2. Both heels must touch the base of the stadiometer.
3. The student is instructed to look straight ahead and take a deep breath and hold for few seconds.
4. Mark the highest point on skull.
5. Measure the height before exhalation.
6. Measurement is taken to the nearest 0.1 cm.



Figure 6.8 Measuring height accurately is important to calculate the BMI.

How to Measure Weight

1. Take a digital scale and place it on a horizontal floor.
2. The student is instructed to remove shoes and heavy clothing.
3. The student is directed to stand with both feet in the centre of the scale.
4. Record the weight to the nearest decimal fraction (for example, 26.1 kg).

Muscular Strength and Endurance

a. Partial Curl-up (Abdominal/Core Strength):

The purpose of this test is to measure the abdominal strength and endurance.

Equipment: Flat clean cushioned surface with two parallel strips (6 inches apart), Stopwatch

Procedure:

The student is asked to lie on her/his back and keep the knees bent at an angle of 90 degrees and the feet about 12 inches from the buttock. Feet



Figure 6.9 Partial curl up

cannot be held or rest against an object. The arms are straight and parallel to the trunk with palms of hands resting on the mat. Set to a specified pace, students complete as many repetitions as possible. The correct curl-up is performed to a pace of one complete curl-up every three seconds (1.5 seconds up and 1.5 seconds down, with no hesitation). The student raises up, reaching the appropriate position: scapula two inches off the ground and lowers down with the shoulders touching the mat. The heels of the feet must remain in contact with the floor. There is no pause in the up or down position. The student should not be allowed to rest between the assessments. Her/his movement should be slow and controlled.

Scoring: Record the maximum number of Curl ups in a certain time period of 30 seconds.

b. Push ups for Boys/Modified Push ups for Girls (Muscular Endurance): The purpose of these tests is to measure upper body strength, endurance, and trunk stability.

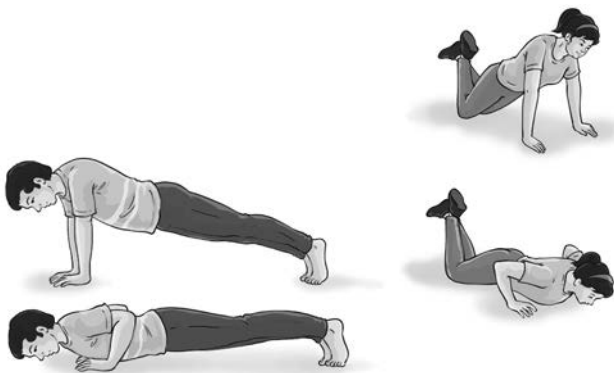


Figure 6.10 Push ups (Boys) and modified Push ups (Girls)

Equipment: Gym mat and paper to record the basic information of the student.

Procedure:

The push up begins with the hands and toes

touching the ground, and the body and legs in a straight line. The feet are kept slightly apart; the arms are at shoulder width apart, extended and at a right angle to the body. Keeping the back and knees straight, the student lowers the body until there is a 90-degree angle at the elbows, then returns to the starting position with the arms extended. The action is repeated until exhaustion or until the time limit is reached. In case of timed tests, the maximum number of correct push ups performed are noted.

Modified Push ups (Girls): Push-up technique is with the knees resting on the ground.

Sit and Reach Test (Flexibility)

The purpose of this test is to measure flexibility of the lower back and hamstring muscles.

Equipment: Sit and reach box (flexometer), mat and ruler.



Figure 6.11 Sit and reach test

Procedure:

After warming-up, the student is asked to sit barefoot on a flat surface with her/his legs extended, toes pointing up and feet slightly apart. The soles of the feet should rest against the base of a flat vertical surface of the sit and reach box. A ruler is placed on the ground between the legs. Placing one hand on top of the other, student is asked to reach slowly forward. At the point of her/his greatest reach, she/he should hold this position for a couple of seconds, and the distance reached is measured.

Scoring: The score is recorded (difference between initial position and final position), in cm and mm, as the distance reached by the hand.

600 M Run/Walk (Cardiovascular Endurance)

The purpose of this test is to measure cardiovascular endurance of students.



Figure 6.12 600 m Run/walk

Equipment: Marked track and two stopwatches for two officials, whistle, marker cone, lime powder, measuring tape.

Procedure:

The student is asked to run or walk for a distance of 600 m from a starting line and the time taken is recorded in min, sec, mm.

For norms for the Health related Fitness Indicators as per Khelo India battery of fitness assessment test, please visit:

<https://fitness.kheloindia.gov.in>.



SUMMARY

1. Test, measurement and evaluation help in setting goals for the students which involves using mental skills such as imagery which can help with skill learning, strategies, presentation and working through competitive anxiety.
2. BMI can be calculated using the following formula:
Body Mass Index (BMI) = $\frac{\text{Body weight}}{\text{Height} \times \text{Height}}$
3. An endomorph is characterised by a soft and round body shape with short arms, legs and neck.
4. Mesomorphs have strong and agile bodies, good metabolism, and respond well to exercise – attributes that fit the physiology of a sports person.
5. Sports suitable for ectomorphs include badminton, tennis, table tennis, gymnastics, track and field and so on.
6. In schools, growth charts are often put up in classrooms in order to help students see for themselves if their height, weight, etc. are normal for their age, or if they are overweight or underweight.
7. The fitness components that are directly related to health or, in other words, whose imbalance will create an ill-effect in the maintenance of good health, are termed as Health-Related Fitness Components.



EXERCISES

A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

1. WHR is the measurement of the
 - (a) wrist circumference divided by height circumference.
 - (b) waist circumference divided by height circumference.
 - (c) **waist circumference divided by hip circumference.**
 - (d) wrist circumference divided by hip circumference.

2. If a person with a height of 1.5 m weighs 75 kg, which of these categories from the BMI chart will apply to him?
 - (a) Ideal
 - (b) Overweight
 - (c) **Obesity Class I**
 - (d) Obesity Class II
3. If a 30-year-old man without any illness has a BMI of 18, which somatotype is he least likely to be among the following?
 - (a) **Endomorph**
 - (b) Mesomorph
 - (c) Ectomorph
 - (d) Data insufficient
4. Which of the following is not a characteristic of endomorphs?
 - (a) Difficulty in losing weight
 - (b) Prone to knee and feet problems
 - (c) Underdeveloped muscles
 - (d) **Thick bones and muscles**
5. What is skinfolds measurement?
 - (a) Manual technique of measuring body fat
 - (b) **Manual technique of measuring body composition**
 - (c) Manual technique of measuring body mass
 - (d) Manual technique of measuring body weight
6. What is the only instrument required for measuring body composition using the skinfold measurement method?
 - (a) Measuring tape
 - (b) Scissors
 - (c) Needle
 - (d) **Calliper**
7. According to the Heath-Carter measurement system for finding out the somatotype of a person, if the three-digit score of an endomorphic person is XYZ, which of the three digits X, Y and Z is likely to be greater than the other two?
 - (a) **X**
 - (b) Y
 - (c) Z
 - (d) Any digit can be greater than the other two
8. Which of these health related fitness components can be defined as the proportion of fat and fat-free mass in the body?
 - (a) Muscular Strength
 - (b) **Body composition**
 - (c) Flexibility
 - (d) Cardiorespiratory endurance

II. Match the following:

Match list – I with list – II and select the correct answer from the code given below:

List I – Fitness Component

- (i) Cardiorespiratory Endurance
- (ii) Core Strength
- (iii) Muscular Endurance
- (iv) Flexibility

List II – Measurement Test

- (1) Partial curl up
- (2) Sit and Reach test
- (3) 600 m Run/Walk
- (4) Push ups

Select the correct set of options:

- (a) (i)–(1), (ii)–(3), (iii)–(2), (iv)–(4)
- (b) (i)–(3), (ii)–(1), (iii)–(4), (iv)–(2)
- (c) (i)–(4), (ii)–(3), (iii)–(1), (iv)–(2)
- (d) (i)–(3), (ii)–(4), (iii)–(1), (iv)–(2)

III. Assertion-Reason Type Questions:

CBQ

Given below are the two statements labelled Assertion (A) and Reason (R).

A: In the field of sports, objectives are set to decide which goals to achieve, and how to motivate and build self-confidence to successfully achieve them.

R: Test, measurement and evaluation are not important factors involved in this process.

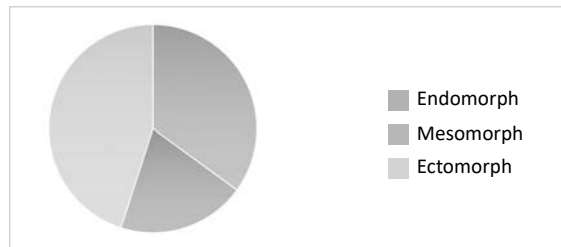
In the context of the two statements given above, which one of the following is correct?

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
- (c) (A) is true, but (R) is false.
- (d) (A) is false, but (R) is true.

IV. Data-Based Questions:

CBQ

A class of students was divided into three categories and the percentage of each category is as follows:



On the basis of the pie-chart given above, answer the following questions:

1. Which of the following categories do maximum percentage of children fall?
 - (a) Endomorph
 - (b) Ectomorph
 - (c) Mesomorph
 - (d) Both (a) and (b)
2. What are the characteristics of the children who fall in Mesomorph category?
 - (a) Lean
 - (b) Muscular
 - (c) Fat abdomen
 - (d) Both (a) and (b)
3. A soft and round body shape with short arms, legs and neck is an example of a/an
 - (a) Endomorph
 - (b) Mesomorph
 - (c) Ectomorph
 - (d) All of these

V. Picture-Based Questions:

CBQ

Identify the following fitness test items:



3.



4.



VI. Case-Based Questions:

CBQ

The BMI for three adults was calculated to be A – 56; B – 27; C – 13.

On the basis of the case given, answer the following questions:

- Person 'A' is
 - underweight.
 - normal.
 - overweight.
 - extremely obese.
- Person 'B' should workout to
 - increase his BMI to 29.
 - decrease his BMI to 17.
 - increase his BMI to 31.
 - decrease his BMI to 21.
- What should be the least ideal BMI for person C?
 - 32.5
 - 25.5
 - 18.5
 - 15.5

B. Very Short Answer Type Questions

- What is BMI and how is it measured?
- Who is an obese person as determined on the body mass index?
- Define Waist-Hip Ratio.
- What is a somatograph?
- Who is (a) an endomorph, (b) a mesomorph, and (c) an ectomorph?
- Define body composition.
- Why is the skinfold measurement method for finding out body composition considered an approximate method?

C. Short Answer Type-I Questions

- Write briefly on the importance of test, measurement and evaluation in sports.
- How is BMI calculated and what are its uses?
- How is WHR calculated and how can it be used to assess the health of a person?
- Briefly explain the somatotypes.
- Discuss the traits of ectomorphs.
- Briefly describe the skinfolds measurement method for measuring body composition.
- Enlist any three of the components of health related fitness.

D. Short Answer Type-II Questions

1. Describe the importance of test, measurement and evaluation in the field of sports.
2. Write an essay on the three somatotypes described by W H Sheldon.
3. What are the differences between endomorphy and mesomorphy?

E. Long Answer Type Questions

1. What is BMI? Explain the method of calculating BMI.
2. Briefly explain the Heath-Carter somatotype measurement system with the help of a somatograph.

7



Fundamentals of Anatomy and Physiology in Sports

PROPERTIES AND FUNCTIONS OF MUSCLES



Figure 7.1
Muscular system

Properties of Muscles

We keep learning about the importance of having strong muscles, but what are their properties?

Muscles are soft tissues made of cells containing actin and myosin proteins. Being soft tissues, they support and surround other organs of the body. The actin and myosin enable contraction by sliding past one another. They perform uncountable functions in the body. In fact, you are able to read this text right now because of muscular movements of the eye.

Muscles come in various shapes and sizes. Muscles beneath the skin are flat, while those of the upper

and lower limbs are long. Skeletal muscles, smooth muscles and cardiac muscles are different types of muscles.

Four properties of muscles help in the performance of all their functions:

1. **Excitability:** The responsiveness of muscle cells to stimulation by nerves and hormones is called excitability of muscles. The greater the excitability, the greater the force, speed and endurance of the muscles. Excitation is triggered when nerve impulses cause the release of acetylcholine, a neurotransmitter, at the nerve-muscle junction. The receptors on the surface of the muscle cells are activated by acetylcholine and positively charged ions are released into the muscle cells, which are negatively charged at rest. Depolarisation occurs and produces action potential. The muscle is ready to perform.
2. **Contractility:** Contractility is the ability of voluntary/skeletal muscle cells to contract forcefully when stimulated. This property is not shared by cardiac and smooth muscles. When a skeletal muscle is excited, the nerve impulse travels through the muscle cells and

causes calcium channels from within the cell to open. The calcium ions bind to troponin, a protein molecule, and change the shape and position of other proteins in the muscle cell, such as myosin, actin and tropomyosin. Finally, myosin binds to myofilaments, which are tiny strands in the cell and pulls them, causing the cell to contract.

3. **Extensibility:** Muscle cells have the ability to extend or stretch themselves. Just as they shorten during contraction, they can extend up to three times their resting length when relaxed without rupturing. Without this property, we would not be able to perform various movements. One skeletal muscle's contraction pulls at another muscle, making the latter extend. For example, while running, the hamstring contracts and quadriceps extend at the same time.
4. **Elasticity:** This property enables muscles to return to their normal resting length and shape after contraction and extension. Without this ability, muscles would lose their strength. For example, if the biceps do not return to their resting length after stretches, they will become loose and loose muscles are unable to produce force.

Functions of Muscles

The functions of muscles are as follows:

1. **To Produce Physical Movements of Every Kind:** Muscles make all kinds of physical movements happen, from the swallowing of food to the twitching of an eye. They are the only body tissue capable of contraction; without

them we will not be able to perform physical activity.

2. **To Maintain Body Posture:** Though the skeleton provides the framework, it is the muscles that hold the numerous bones together and support them to give the shape of the human body. Even when we are sitting, the position is made possible by muscles of the legs, trunk and neck.
3. **To Protect Organs of the Body:** Muscles work together with the ribs and the spine to keep internal organs like those in the abdominal area safe.
4. **To Circulate Blood:** Cardiac muscles pump blood throughout our body, taking it to the lungs for oxygenation and then helping in the distribution of oxygenated blood to the other areas of the body.
5. **To Execute Internal Organ Functions:** Though we are generally not aware of it, involuntary muscles work hard for the smooth functioning of internal organs, such as movement of food in the body, expulsion of urine, etc.
6. **Regulating Body Temperature:** Skeletal muscles help our body retain its internal temperature when exposed to conditions that might lower it. When it suddenly gets cold, your body starts shivering; this is a sign of your skeletal muscles contracting to produce heat inside the body. Smooth muscles of the blood vessels restrict the supply of blood to the skin so that loss of body heat on the surface is limited. In the opposite situation, these muscles relax to increase blood flow and loss of heat through the surface.

EXERCISES



A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

1. What are muscles made of?
 - (a) Blood vessels
 - (b) Bones
 - (c) **Actin and myosin proteins**
 - (d) Nerves

2. Which property enables muscles to return to their normal resting length and shape after contraction and extension?
 - (a) Excitability
 - (b) Contractility
 - (c) Extensibility
 - (d) **Elasticity**
3. Which type of muscle helps in the circulation of blood?
 - (a) Skeletal muscle
 - (b) Smooth muscle
 - (c) **Cardiac muscle**
 - (d) Involuntary muscle
4. What is the function of skeletal muscles in regulating body temperature?
 - (a) To help the body retain internal temperature
 - (b) To increase blood flow to the skin
 - (c) To limit the supply of blood to the skin
 - (d) **To contract and produce heat inside the body**

B. Very Short Answer Type Questions

1. What enables contraction in muscles?
2. What is the function of smooth muscles in regulating body temperature?

C. Short Answer Type-I Questions

1. What is excitability in muscles? How is it triggered?
2. What is contractility in muscles? How does it work in skeletal muscles?

D. Short Answer Type-II Questions

1. What is the role of muscles in maintaining body posture?
2. How do involuntary muscles work in the body?

E. Long Answer Type Question

1. Explain the various functions of muscles in the human body.

8



Fundamentals of Kinesiology and Biomechanics in Sports

KINETICS AND KINEMATICS IN SPORTS

The human body has evolved through mutations to its present unique form. Although the human body is distinct in its anatomy and physiology, it is subject to the same laws and principles that apply to animate and inanimate objects in the universe.

Kinetics and Kinematics in Sports Biomechanics

Sports biomechanics is the study of the mechanics of human movement. It is traditionally divided into kinetics and kinematics. Kinetics studies the relationships between the forces acting on the body and how they affect motion, while kinematics

describes the geometry of objects' motion, including displacement, velocity and acceleration.

Kinematics

Kinematics analyses motion in terms of time, displacement, velocity or acceleration. It describes the motion of an object in either a straight (linear) or a rotary (angular) direction. Kinematics is the mechanics of motion without reference to the forces causing that motion. It involves the displacement and velocity of body segments and joints.

Kinetics

Kinetics considers the action of forces in producing or changing motion. It looks at the influence of interacting objects and how they react with each other. Force may be a pull or a push, and human levers produce force to overcome resistance. Kinetics considers the forces that cause motion and includes Newton's three laws of motion.

Table 8.1 Difference between Kinetics and Kinematics.

	Kinetics	Kinematics
1.	It deals with the forces that cause motion.	It deals with the geometry of motion
2.	It involves the study of forces that affect motion.	It involves the study of displacement, velocity and acceleration.
3.	Considers the influence of interacting objects and how they react with one another.	Considers motion without reference to the forces causing it.
4.	Includes Newton's three laws of motion.	Does not consider Newton's laws of motion.
5.	Focuses on the muscles that cause movement.	Focuses on the motion of body segments and joints.
6.	Describes the action of forces in producing or changing motion.	Describes motion in terms of time, displacement, velocity or acceleration.
7.	It is the study of the motion considering the mass and external forces as well.	It is the mechanics of motion without reference to the forces causing that motion.

8.	It is concerned with how external forces create motion or change motion.	It is concerned with the spatial and temporal characteristics of motion.
----	--	--

Fundamental Kinematic Quantities

Fundamental kinematic quantities include time, position, displacement (distance), velocity (speed), and acceleration. The shapes of trajectories of various points on the body, club and orientation of motion planes of multiple body segments and clubs are also kinematic issues. A complex motion of an object can be resolved into the linear motion of the centre of mass of the body and the angular motion of the body about its centre of mass, which is also a kinematic issue. The kinematic sequence plot is based on the angular velocity patterns of body segments, lines and clubs.

Measurement of Motion

To accurately describe the motion, it is essential to measure it accurately. Therefore, measurement of motion is one of the central aspects of kinematics. For example, in the study of the golf swing, kinematics focuses on details of the swing motion such as the shape of the club-head, its path,



Figure 8.1 Kinematics places great emphasis on the measurement and analysis of motion.

position of the body and club at various swing events, velocities of the body parts and club, and

the timing of slow-down of the body for speed-up of the club.

EXERCISES



A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

1. What is sports biomechanics?
 - (a) **The study of motion in sports.**
 - (b) The study of forces in sports.
 - (c) The study of injuries in sports.
 - (d) The study of strategies in sports.
2. What is Kinematics in sports biomechanics?
 - (a) The study of forces acting on the body.
 - (b) The study of relationships between forces and motion.
 - (c) **The geometry of motion without reference to forces.**
 - (d) The study of displacement, velocity and acceleration.
3. What is Kinetics in sports biomechanics?
 - (a) **The study of forces acting on the body.**
 - (b) The study of relationships between forces and motion.
 - (c) The geometry of motion without reference to forces.
 - (d) The study of displacement, velocity and acceleration.
4. What are fundamental kinematic quantities?
 - (a) Time, force, motion, acceleration
 - (b) **Time, position, displacement, velocity, and acceleration**
 - (c) Displacement, velocity, speed, acceleration
 - (d) Force, motion, position, velocity

B. Very Short Answer Type Questions

1. What is the difference between Kinematics and Kinetics in sports biomechanics?
2. What is the importance of accurate motion measurement in sports biomechanics?

C. Short Answer Type-I Questions

1. Define Kinematics in sports biomechanics.
2. Define Kinetics in sports biomechanics.

D. Short Answer Type-II Questions

1. What are the fundamental kinematic quantities?
2. What is the kinematic sequence plot in sports biomechanics?

E. Long Answer Type Question

1. Explain the difference between Kinematics and Kinetics with examples from sports biomechanics.



Psychology and Sports

DEVELOPMENTAL CHARACTERISTICS AT DIFFERENT STAGES OF DEVELOPMENT

Characteristics of Growth and Development

There are four main areas of growth and development—physical, mental, social and emotional. Growth and development of a person are the outcomes of interaction among these four aspects. Researches in the subject of growth and development have led to the inclusion of the following characteristics of growth and development:

- ❖ **Continuity:** Changes begin from infancy and continue till old age. Some changes are external while some are internal.
- ❖ **Orderly Sequence:** Human development occurs in an orderly sequence. For example, the development of head followed by lower parts and legs or the development of motor skills in a child which starts with sitting, then progresses to crawling, standing and walking.
- ❖ **General to Specific:** Development moves from the general to the specific.

Table 9.1 Areas of growth and development and their characteristics.

S. No.	Areas of Growth and Development	Characteristics
1.	Physical	height and weight
2.	Mental	thinking and understanding
3.	Social	interacting with others
4.	Emotional	feelings and attitudes

- ❖ **Individual Differences in the Rate of Development:** Rate of development differs for each individual, though the process may be similar.
- ❖ **Heredity and Environment:** Genetic structure and interaction with the environment also influence the development of an individual.

Stages of Growth and Development

Infancy (0–2 years)

- ❖ Physical characteristics include soft, small, flexible and underdeveloped muscles and bones; uncoordinated movements; disproportionate body parts. Female and male infants exhibit a similar pace in growth.
- ❖ Muscles and muscle control develop fast and motor skills are gradually obtained. Perception of colour starts at about 3–4 months; eyes become mature at 6 months.



Figure 9.1 Growth and development of an infant

- ❖ With the development of the nervous system, the infant also learns coordinated patterns of movement. The infant learns to sit, crawl, stand, walk, run and jump in an orderly sequence.
- ❖ As for emotional and mental development, the infant is first guided by feelings of pain and pleasure. Fear, anger and love are the dominant emotions at this stage. It cries to attract its mother’s attention when it is hungry or when it

is experiencing some discomfort. It also smiles and giggles to show fulfilment and happiness.

- ❖ An infant's brain is quite sharp and has great retention of memory, although attention switches easily from one thing to another in an effort to respond to various stimuli. It becomes aware of its environment and picks up signs, language and behaviour. An infant learns mostly from parents, family members and peers.
- ❖ An infant eventually starts to participate in daily activities and begins to address wants and needs. The curiosity of an infant is famous for being unlimited. It may ask questions about things which are new and uncertain.
- ❖ The infant also begins to take a stand for itself and gains a personality.
- ❖ Activities that interest an infant include running, throwing and kicking balls, playing with toys, etc.

Childhood (2–11 years)

- ❖ Childhood stage is divided into early childhood (2 to 6 years) and late childhood (6 to 11 years).
- ❖ The speed of physical growth is fast in the first three years and it slows down subsequently. Bones are still soft and can be easily deformed or broken in the first half of childhood. This also means bones are more flexible at this stage, so the child should be taught how to maintain correct posture before ossification occurs.

- ❖ The child also gains weight steadily, though physical strength is still weak. Neuromuscular coordination, however, shows vast improvement in this period and movements and reflexes become automatic.

- ❖ Pulse rate is higher compared to adults, while blood pressure is lower. Baby teeth are replaced.

- ❖ Energy level is high but diminishes quickly as endurance is still poor.

- ❖ Mental and emotional intelligence grows at a fast pace. Memory, logic and decision-making abilities are attained and put to use, both in daily life and in the educational arena. Hobbies are developed.

- ❖ The child also begins to have a good grasp of social skills and interacts with the environment. She/he emulates those whom she/he admires, which may be anyone from its personal life, a celebrity, etc.

- ❖ The child undergoes the process of establishing a personality. In childhood, an individual is more adventurous, imaginative and resourceful.

- ❖ A child is more self-centred in the early stage of childhood. This attitude changes in the latter half when she/he becomes helpful and cooperative.

- ❖ In the latter half, the child also loses interest in rhythmic activities and acquires a taste for specific activities and sports. Gender differences and preferences become pronounced.



Figure 9.2 Physical activities enhance healthy growth and development.

Adolescence (11–20 years)

- ❖ This is period of transition from childhood to adulthood – arguably the most complex phase of an individual's growth and development.
- ❖ Physical growth is extremely fast in this stage. Bones and muscles grow in size and strength, height shoots up. The heart increases in size; the skeleton is well calcified. The individual gains physical strength, endurance and agility to a great degree.
- ❖ Motor skills and coordination are well-defined.
- ❖ The onset of puberty brings along the development of sexual organs and sexuality. It is also seen in physical changes like deepening of the voice, growth of facial and pubic hair, menstruation in females, broadening of the shoulders in males, enlargement of the breasts in females, etc.
- ❖ Adolescence is a stage full of emotional complications. It is marked by sexual awakening and curiosity, social anxiety, competitiveness and the intense desire to have an identity. Some adolescents can cope with these new trials and desires successfully. They sharpen their leadership skills, become good decision makers, feel the environment intelligently, respond critically and use their time fruitfully. Others are not so lucky. Depression is a common disease amongst teenagers who are troubled by their inability to fit into the general mould. Anger, jealousy, fear, agitation, and hatred are

strongly felt and expressed. They turn into rebels, disrespect authority figures and may respond in violent ways.

- ❖ Friendship is highly valued during adolescence, and loyalty is expected from one's friends. Often, groups are created with their own specific codes of conduct and principles.
- ❖ Feelings towards other individuals also begin in this stage.

Adulthood

- ❖ This stage is further divided into early adulthood (20 to 40 years), middle adulthood (40-65 years) and late adulthood (65 years and above)
- ❖ The development of physical health, strength, energy, sensory and motor systems is at its peak in early adulthood stage.
- ❖ In early adulthood stage, people gain weight and the height increases. Family-oriented behaviours and commitment towards relationships are seen.
- ❖ In middle adulthood, gradual decline in physical abilities, efficiencies and motor components are observed.
- ❖ Women in their middle adulthood stage, go through various hormonal changes that leads to menopause. In this stage, people usually reflect relatively stable personality and strong social networking.
- ❖ Late adulthood is also known as old age (65 years and above).

Figure 9.3 Exercise aids in the development of important interpersonal skills.



❖ In the late adulthood stage, the physical health and faculties start declining. People are prone to various diseases. They plan to retire from work.

Some physical activities for each stage of growth and development are summarised in Table 9.2.

Table 9.2 Recommended physical activities for each stage of growth and development

Age Group	Activities
Infants (0–2 years)	Reaching, rolling, sitting, standing, crawling, pulling up, standing, lying on the tummy and lifting the head; activities focusing on muscle development.
Early childhood (2–6 years)	Catching, hitting, bouncing, kicking, throwing, jumping, dancing, riding a bike; playing with peers
Late childhood (6–11 years)	Simple activities that focus on motor skills development rather than competitiveness or cognitive skills, such as running, hopping, striking, kicking, throwing for accuracy, etc.
Adolescent (11–20 years)	Activities that require cognitive skills and decision-making as well as instil competitiveness. Sports like swimming, basketball, cricket, football, badminton, etc. are good examples. All sorts of sports practised, including dance forms, yoga, indoor rock climbing, trekking, etc.

INTRODUCTION TO PSYCHOLOGICAL ATTRIBUTE – ATTENTION, RESILIENCE, MENTAL TOUGHNESS

Attention

Attention in sports refers to the ability of athletes to focus on the task at hand, which includes taking possession by the mind, in clear and vivid form, of one out of what seems several simultaneously possible objects or train of thoughts. It is the concentration of mental effort on sensory or mental events, focusing on addressing relevant environmental cues and elimination of irrelevant

cues. Attention is essential for athletes to perform well in sports, as it helps them to focus on their role in relation to other teammates, set of situations, and specific stimuli on the playfield, which increases their readiness to receive and respond to the situation involved.

Importance of Attention in sports performance

Attention is a complex process, and there are different types of attention focus, such as narrow and broad attention focus, and external and internal attention focus. Each type of attention style has specific utility for specific sports. For example, broad attention focus allows athletes to perceive several occurrences simultaneously, while narrow attention focus is the ability of the athlete to focus on a particular or important task when surrounded by multiple cues. External attention focus directs an athlete to focus outward or attend to other objects or cues other than their own self, while internal attention focus directs inward thoughts without attending to the external cues or objects.

Resilience

Resilience refers to one's ability to bounce back emotionally in the face of adversity. It is also a crucial aspect that helps athletes cope with life's challenges and adapt to them by integrating a wide range of traits, habits and skills. A resilient athlete is one who has the ability to recover from failures, injuries, and other challenges they may face in their sporting careers.

Mental Toughness

Mental toughness is another important factor required for attention in sports. It is a multifaceted construct made up of multiple key components. These components include values, attitudes, cognitions, emotions and behaviours, that refer to an individual's ability to thrive through both positively and negatively construed challenges, pressures and adversities. Mental toughness is having the natural or developed psychological edge. It enables athletes to cope better than their opponents with the many demands that sports place on them, and be more consistent and better than their opponents in remaining determined, focused, confident and in control under pressure.

EXERCISES



A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

- According to the characteristics of growth and development, which of the following is true?
 - Development moves from specific to general.
 - Changes occur only in old age.
 - Rate of development is the same for all individuals.
 - Genetic structure and environment influence growth and development.**
- Which of the following is an example of an orderly sequence in human development?
 - Development of specific skills before general skills
 - Development of legs before head
 - Development of motor skills in a child starts with crawling, then standing, then sitting**
 - Development of emotional skills before social skills
- What is attention in sports?
 - Ability to focus on the task at hand**
 - Physical ability of athletes
 - Ability to communicate with teammates
 - Ability to remember past experiences
- Which type of attention focus allows athletes to perceive several occurrences simultaneously?
 - Narrow attention focus
 - Broad attention focus**
 - External attention focus
 - Internal attention focus
- What is mental toughness in sports?
 - Ability to lift heavy weights
 - Ability to cope with challenges and adversities**
 - Ability to run fast
 - Ability to score goals
- What is resilience in sports?
 - Ability to recover from failures and injuries**
 - Ability to score goals
 - Ability to lift heavy weights
 - Ability to run fast

II. Match the following:

Match list – I with list – II and select the correct answer from the code given below:

List I – Age Group

- 0–2 Years
- 5–9 Years
- 10–12 Years
- 13–19 Years

List II – Activity

- Activities requiring cognitive skills
- Activities focusing on muscle development
- Activities focusing on motor skills
- All sorts of sports

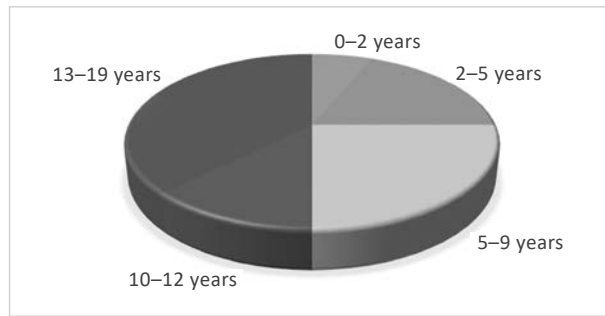
Select the correct set of options:

Code				
	(i)	(ii)	(iii)	(iv)
(a)	4	2	3	4
(b)	1	3	2	3
(c)	3	1	4	2
(d)	2	4	1	1

III. Data-Based Questions:

CBQ

A housing society had children of various age groups, the numbers have been given below:



On the basis of the pie-chart given above, answer the following questions:

1. What are the children falling in the 2-5 Years category called?
(a) Toddlers (b) Children (c) Infants (d) Kids
2. What sort of activities do the children in the age group of 5-9 years indulge in?
(a) Catching, hitting and bouncing (b) Reaching, rolling and sitting
(c) Running, hopping and striking (d) Hiking, trekking and swimming
3. Which age group faces the problems of peer pressure, emotional and physiological changes?
(a) 13-19 Years (b) 2-5 Years (c) 5-9 Years (d) all of these

IV. Picture-Based Questions:

CBQ

Identify the activities and write the age group for which they are best suited:

1.



.....

2.



.....

3.



.....

4.



.....

B. Very Short Answer Type Questions

1. What are the four main areas of growth and development?
2. What does the characteristic of continuity mean in growth and development?
3. What is the importance of attention in sports performance?
4. What are the different types of attention focus?

C. Short Answer Type-I Questions

1. Explain the characteristic of 'general to specific' in growth and development.
2. How do individual differences in the rate of development affect growth and development?
3. What is the role of broad attention focus in sports?
4. How does mental toughness help athletes in sports?

D. Short Answer Type-II Questions

1. How do heredity and environment influence growth and development?
2. What is the role of narrow attention focus in sports?
3. What are the key components of mental toughness?

E. Long Answer Type Questions

1. Explain how the four main areas of growth and development are interconnected.
2. Explain the concept of resilience in sports and its importance.



10

Training and Doping in Sports

WARMING-UP AND LIMBERING DOWN – TYPES, METHOD AND IMPORTANCE

Meaning of Warming-up

Warming-up is a process of preparing the body before training or competition by performing light exercise. It is a combination of rhythmic exercise which raises the heart rate and muscle temperature and static stretching through a full range of motion. The nature of this process depends on the activity or sports in question. It ensures the

efficiency of that activity by preparing the body physically, mentally and psychologically. It is a basic part of any training or sports. It stimulates the muscles and parts of the body which are involved in that particular activity and makes them open-minded. Thus, it helps the sportsperson to deliver good performance. Running, jogging or freehand exercises are some of the activities for warming-up. Warming-up can be described as follows:

“To engage in exercise or practice especially before entering a game or contest.”

– Merriam Webster Dictionary

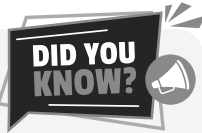
“Preparatory exercises done to warm-up the muscles.”

– Collins Dictionary

Hill stated that *“if normal temperature of body is decreased slightly, then the reaction time will be increased, contractile time will also be increased and extension of muscles will be less”*. On the other hand, if body temperature is increased more than normal temperature, then contractile force and speed of muscles will be increased.

There are researchers and scholars who feel warming-up is an unnecessary wastage of energy and time. In their opinion, warming-up reduces the capacity of sportspersons to perform at their best when it really matters. The majority of experts are however in favour of practising warming-up before any activity; their only warning is that an unnecessarily strenuous warming-up produces disadvantages which should be avoided. Hence, moderation and specific warming-up should be observed. Otherwise, the muscles will get damaged and the players will run the risk of injuries, disabilities and inefficiencies, temporarily or permanently. If a runner, for example, participates in an event without proper warming-up, then she/he may suffer knee, ankle or leg injury.

Furthermore, there will be minimum chances of mistakes if sportsperson’s senses and body parts are prepared in advance before the play. It helps them to perform well from the very start. There are many instances of basketball players missing the mark while attempting to shoot the ball in the ring without an efficient warming-up exercise.

- 

 1. Too much exercise can be almost as bad as too little. People who are new to exercising sometimes get injuries. This is because they have not warmed-up properly or have done too much, too quickly.
 2. According to sports doctors, time spent in warming-up and cooling down will improve an individual’s level of performance and accelerate the recovery process needed before and after a competition or a training session.

Types of Warming-up

Passive Warming-up: When a body is subjected to increase in temperature through external means and without undergoing any physical activity, then this process is known as passive warming-up. It can be done by wearing heavy uniforms, massage, hot water, steam, sunlight, hot drinks, etc. As no energy is used in this process, it is an efficient method. But it should be accompanied by active warming-up in order to achieve positive outcomes.

Active Warming-up: Active warming-up involves direct participation of an athlete in various physical exercises like jogging, stretching, etc. It raises the body temperature to the required amount and enhances the durability of muscles. In short, these activities help sportspersons to perform better. There are two types of active warming-up:

1. **General warming-up:** It involves various exercises such as jogging, running, jumping, stretching,

Table 10.1 Some of the warming-up techniques of their related games:

Name of game	Warming-up techniques
Cricket	Running, catching, fielding, stretching, etc.
Badminton	Forward bending, sideways bending, backward bending, body twisting exercises, etc. are the instances of specific warming-up.
Basketball	Dribbling, shooting, lay up shots, shuttle run, dodging and free throws, etc. are applied.
Tennis	Lunge walks, buttock kicks, jumping, stretching sides, wall tennis, service practice, passing shots and knocking, etc.
Football	Lunge walks, chest hugs, running backwards, side-stepping, etc.
Shot put	Shifting the shot from left hand to right hand and vice versa, standing throws, putting the shot with both hands, gliding practice with or without shot, etc.
Hockey	Dribbling, rotation of stick, stopping the ball with stick, short passes, long hits, scoop, etc.

callisthenics, etc. The main objective of these exercises is to improve the overall capacity of the body in terms of muscle and joints flexibility, muscle tone and coordinative abilities. The type of activity determines the duration of general warming-up sessions.

2. **Specific warming-up:** Specific warming-up is taken up to improve the various skills which are essential in a specific game or sport. It is performed after the activities of general warming-up. It differs from sport to sport, as per the specific requirements for a particular sport. For instance, a tennis player undergoes service practice while a cricket player practises bowling or catching. This type of warming-up focuses on those skills that are used in the game.

Methods of Warming-up

There are various methods of warming-up:

- ❖ General Method
- ❖ Warming-up with Warm Water
- ❖ Warming-up through Massage
- ❖ Through Sunbath
- ❖ Through Steam bath

General Method:

1. **Jogging:** Generally, 5 to 10 minutes of jogging or slow running is preferable but younger athletes may do so for only 3 to 5 minutes. The speed should be increased slowly. It raises the body temperature.
2. **Simple Exercises:** Jogging should be followed by simple exercises from a relaxed state and then, further moving on to complex exercises.
3. **Striding:** This exercise includes taking long strides, bringing the knees high, arms in a running posture and the body leaning forward. The strides should not be stretched over the limit. Four to eight repetitions should be performed, each covering a distance of 50 metres.
4. **Stretching:** Stretching improves muscle flexibility which is very important for athletes during their performance. It makes the muscles stronger, healthier and more responsive. It reduces risks of injuries.



Figure 10.1 Slow running or jogging is the starting of warming-up.

5. **Wind Sprints:** Wind sprints are performed at the end of warming-up, usually with spikes on. A distance of 25 to 30 m may be covered in this. On the basis of age, sex and experience of the athlete, four to eight repetitions are performed.

Warming-up with Warm Water

In developed countries, warm water is used for warming-up. Shower is another method used by swimmers, divers, water-polo players, etc.

Warming-up through Massage

This is an old technique and a very effective way for healing muscle injuries. In India, it was used by wrestlers. Now, this method is not used anymore.

Through Sunbath

Although, it can warm-up the body to a certain degree, it is not applied in most sports.

Through Steam Bath

This method makes no use of energy while warming-up the body. But it is not used often.

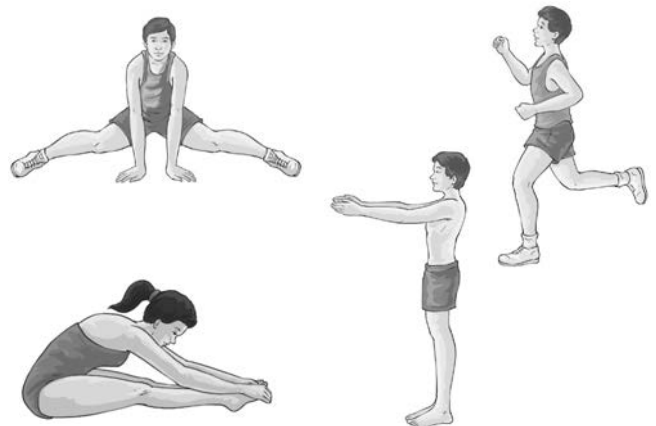


Figure 10.2 Warming-up exercises

Importance of Warming-up

Noted educationists and exercise experts agree on the fact that performance in sports can be remarkably improved by warming-up. The importance of warming-up can be enumerated as follows:

1. **To Raise the Body Temperature:** When the body is warmed-up properly, the temperature of muscles increases. This improves the flexibility of muscles and strengthens contraction force. The rate of contraction and relaxation also increases. Therefore, the body becomes ready for intensive activities without the risk of damage such as tearing of muscle fibres.
2. **To Decrease the Viscosity of Muscles:** At the start of an exercise, concentration of previously unused muscles is irregular and weak and the relaxation is incomplete. As the activity progresses, this contraction becomes stronger and regular and the relaxation is complete. This is the result of reduction in the viscosity of muscles.
3. **To Increase the Speed of the Nerve Impulses:** During warming-up, the body is stimulated and the speed of nerve impulses increases. This enhances reaction time which is an important factor in every sport.
4. **To Reduce Muscle Capillaries Resistance:** Many studies indicate that warming-up reduces muscle capillaries resistance.
5. **To Increase the Speed of Transfer of Oxygen and Fuel to Tissues:** Small blood vessels dilate and blood flows through muscles faster as a result of warming-up. This increases the speed of transfer of oxygen and fuel to various tissues. Consequently, muscles perform efficiently due to rich oxygen supply.
6. **To Increase Metabolic Rate:** Raising the body temperature through warming-up increases the metabolic rate. This causes higher energy production which improves performance.
7. **To Reduce Anxiety and Tension:** Warming-up helps athletes to suppress anxieties and tensions by bringing up their confidence level, more importantly in the games.
8. **To Boost Cooling Efficiency:** Warming-up facilitates the commencement of the cooling process such as sweating, which counteracts overheating during the start of training or game.
9. **To Reduce the Blood Lactic Acid:** Muscle temperature is directly related to heart rate and consumption of oxygen. Rise in body temperature will lead to higher rate of oxygen consumption and heart rate and this will reduce blood lactic acid.
10. **To Avoid Injury:** Many scholars like Morehouse and Miller have claimed that absence of warming-up may result in muscle injuries. Muscles tend to cramp more when they are loosened. After proper warming-up, muscles react faster.
11. **To Increase the Speed of Muscles:** Relaxed fibres sometimes fail to respond to the sudden pull exerted on them by the quickly contracting muscles, leading to pulled muscles. Warming-up can prevent this by getting the relaxed fibres to slowly heat up and respond effortlessly to the pressures demanded by intense activities.
12. **To Increase Flexibility:** Warming-up makes the body more flexible and enables sportspersons to reach their maximum level of performance.
13. **To Increase Strength:** An efficient warming-up practice increases strength whereas local warming-up reduces it.
14. **To Increase Endurance:** Contrary to the beliefs of some physiologists, studies have shown that a specific form of warming-up increases endurance as well as speed. The finding of Thomson shows that formal warming-up exercises improve swimming endurance. Mangel's studies have proven that intensive warming-up enhances performance in the one mile run. So, warming-up has a direct impact on endurance.
15. **To Increase Explosive Power:** Explosive power is associated with speed and strength. Since warming-up enhances speed and strength, there is significant improvement in explosive power. Many experts have supported this fact.
16. **To Improve Specific Skills:** Every sport requires a specific set of skills to perform well. If the

nature of warming-up is directed towards those skills, we can become much better at them.

- 17. To Improve Neuromuscular Coordination:** Warming-up improves neuromuscular coordination. For example, a tennis player may deliver a false service if she/he omits warming-up. But warming-up enables her/him to serve right by improving neuromuscular coordination.
- 18. Warming-up Brings Second Wind more Readily:** When the body is subjected to perform above its normal condition, the body prepares itself to meet the increased demands. It will be able to meet those demands when second wind is reached. So, an effective warming-up exercise can bring second wind readily. Sometimes sportspersons do not feel it at all.

Physiological Basis of Warming-up

- 1. Increase in Body Temperature:** As we already know, warming-up increases the temperature of the body and its muscles, which is beneficial for sports players.
- 2. Decrease in the Viscosity of Muscles:** Warming-up helps in the gradual strengthening of muscular contractions and completion of relaxation. This decreases chance of injury and muscular damage.
- 3. Increase in the Speed of Nerve Impulses:** Warming-up enhances reaction time of the players by increasing the speed of nerve impulses.
- 4. Decrease in the Resistance in Muscle Capillaries:** Warming-up decreases the resistance of muscle capillaries and brings the muscles in a state of readiness.
- 5. Increase in the Speed of Transfer of Oxygen and Fuel to Tissues:** By dilating the small blood vessels, warming-up increases the flow of blood and consequently the speed of oxygen and fuel transfer, thereby empowering the muscles.
- 6. Increase in Metabolic Rate:** As the rate of metabolism increases, so does the energy level. An increase of body temperature by 0.5 degree

Celsius leads to a rise in the rate of metabolism by 7%.

- 7. Reduction of Blood Lactic Acid:** The consensus of coaches and medical experts on blood lactic acid is that it is responsible for causing tiredness and slow recovery of muscles in athletes. With high heart rate and consumption of oxygen, blood lactic acid is gradually reduced.
- 8. Increase in Working Capacity:** As a result of the combined beneficial physiological effects of warming-up, the working capacity of the player's body is upgraded and they can fully utilise their potential and deliver a successful performance.

Guiding Principles of Warming-up

Given below are the guiding principles of warming-up which can aid in the execution of the best performance:

- 1. Simple to Complex:** This principle states that simple exercise or activity should be performed at the start of warming-up, followed by complex exercise. The nature of the exercise should not be exceedingly complex otherwise it will lead to exhaustion and decline the performance at the competitive stage.
- 2. Exercise for all Parts of Body:** This principle means that warming-up should include exercise of all parts of the body. It should aim at making use of every part of the body. For example, boxers should exercise not only their arms but all the other parts of the body.
- 3. Stretching and Loosening Exercises should be Included:** Stretching and loosening exercises prevent injuries and increase flexibility. They also prepare the body to use its full potential.
- 4. Intensive Enough to Raise Body Temperature:** The extent of warming-up should be intense enough to raise the body temperature. It should be devoid of exhaustion. This technique is very helpful for mature sportspersons.
- 5. Age and Sex Specific:** The efficiency of warming-up depends on age and sex criteria. The extent of intensity and time for warming-

up should be more for boys than girls of the same age. It is a well-known fact that men need a longer period of training as compared to women. This should be always kept in mind.

6. **Activity or Sports Specific:** Warming-up should focus on enhancing the abilities that are required in a particular activity or sports. Hence, it should be based on the activity or sports and the movements specific to them. For instance, a boxer should practice punching, while a footballer can do backward running to prepare the calf muscles.
7. **Warming-up should be Timed Accurately:** Warming should be of a duration of 15–20 minutes and should cease 5 minutes before the actual competition. This is to ensure recovery time. This duration must remain the same almost every time. Amateur athletes are advised not to use the same amount of time as that used by mature athletes as it will cause tiredness.

Meaning of Limbering Down

Limbering down, also known as warming down, is the process of cooling down the body to restore it to its normal condition after a training or game. It is a basic part of every training and game.

To limber down, an athlete has to undergo certain activities. Jogging or walking for 5 to 10 minutes is recommended to lower the body temperature and eliminate waste products from

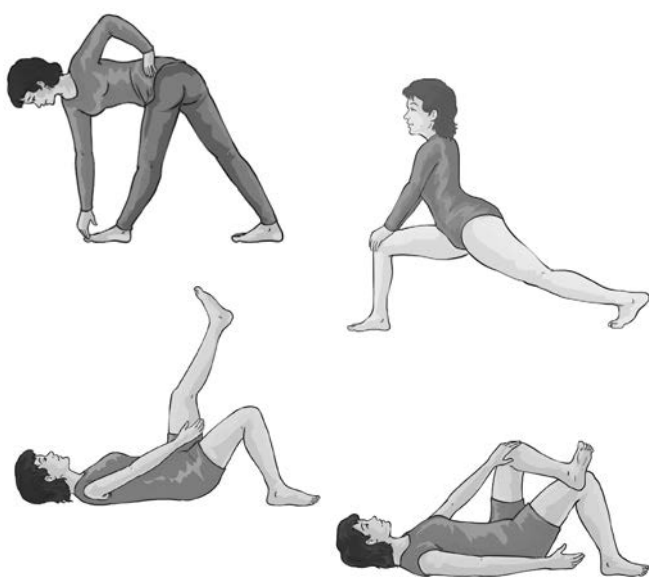


Figure 10.3 Limbering down exercises

the working muscles. Static stretching should be performed next for 5–10 minutes. It allows the muscles to relax, realign muscle fibres and restore their normal range of movement. All the muscles used in the training or competition should be stretched. Each stretch should be held for 10–20 seconds and repeated two to three times minimum.

The common stretches used in limber down are as follows:

1. **Hamstrings:** Lie on your back, then raise and stretch one leg directly above the hips. Holding the calf or thigh, press the heel of the stretched leg towards the ceiling as you lower the leg back towards the chest. Repeat the same stretch with the other leg.
2. **Chest:** Stand erect and interlace your fingers behind your back. Straighten your arms as you lift your chin towards the ceiling.
3. **Glutes:** Lie on your back, bend the left knee and cross the right leg over it. Now draw the left knee towards the chest, holding on to the back of your thigh, and gently press the right knee wide. Repeat the same stretch switching legs.
4. **Quadriceps:** Lie down on your side with your shoulders, hips and knees in a straight line. Bring your heel towards your bottom pulling at the ankle until you feel a stretch in the front of your thigh. Hold the position for 30 seconds.
5. **Triceps/Shoulders:** Bring the right arm across your body and over your left shoulder, holding your elbow with your left hand, until you feel a stretch in your tricep. Repeat with the other arm.

Benefits of Limbering Down

Limbering down is as important as warming-up to restore the body to its normal condition after training or a competition. Athletes often do not practise it. But it should never be neglected. Here are some benefits of limbering down:

1. **Restoring the Body's Normal Temperature:** The body temperature rises above the normal,

when it undergoes intense and strong activity or competition. Proper cooling brings it down to its normal temperature.

- 2. Eliminates Waste Products:** During training or competition, waste products such as lactic acid, uric acid, phosphates, sulphates, chlorides and carbon dioxide, etc. are collected in the body. It results in poor working of muscles. Cooling down eliminates these wastes effectively and rapidly.
- 3. Reduces Tension:** An efficient cooling down helps to relax the tense muscles resulting from training or competition. It can also suppress mental tension to a certain point.
- 4. Decreases the Chances of Dizziness or Fainting:** Blood vessels of the lower limbs expand to enable increased amount of blood flow during a strong activity. If the activity is stopped abruptly, heart rate slows down while the excess blood piles up in those regions. This causes fainting or dizziness. Athletes whose heart rate slows down quickly are far more prone to this side effect. Cooling down decreases the heart rate slowly and prevents blood storage in the legs and feet. The blood proceeds to flow back to the heart through the veins. As a result, the chances of dizziness or fainting are reduced.
- 5. Supply of Oxygen:** Unlike in the normal restive state, oxygen supply is less during intense physical activities. Proper cooling down results in supply of oxygen and blood to muscles, re-establishing the normal condition. Also, the body will recover quickly.
- 6. Decreases Adrenaline in the Blood:** There is an adrenaline rush in the blood when the body is subjected to warming-up and training or competition. It increases the rate of blood flow. Cooling down assists in restoring it to its normal rate by decreasing the level of adrenaline in the blood.
- 7. Muscles do not Remain Stiff:** Cooling down helps in relaxing the stiff muscles quickly. Muscle fibres become linear and return to their normal condition which was altered during training or competition. In the absence of a thorough cooling down, the muscles will remain stiff.

8. Heart Rate Returns to a Normal State:

Cooling down helps in restoring heart rate to its normal rate at a gradual pace. The effect will not be instantaneous, however, it usually takes 30 beats more or less. It also depends on the kind of activity performed and the physical state of the athlete. In that case, the nature of cooling down should be improved along with an increased frequency of static stretching exercises.

CONCEPT OF SKILL, TECHNIQUE, TACTICS AND STRATEGIES

For an athlete to perform optimally on the playground, skill, technique and style are crucial attributes. Although some individuals possess natural abilities such as speed, agility, coordination, flexibility, balance and reaction time for a particular game or sport, they still need to hone and perfect their skills through frequent practice to achieve their desired outcome. Simply put, skill is a learned and practiced ability that enables athletes to achieve their desired outcome with maximum efficiency and certainty. Technique involves the well-timed and coordinated sequence of muscle actions to perform a fundamental skill or activity in a sport, ensuring the best performance while minimising the risk of injury. Style, on the other hand, refers to an individual's way of adapting skill and technique to improve their performance intelligently. It varies



Figure 10.4 Some fundamental skills and techniques are essential for players to reach an elite level of the game.



Figure 10.5 Discrete skill has a definite ending and beginning.

from player to player, and is the demonstration of the physical and psychological prowess of each.

Meaning of Skill

The meaning of skill in sports can be understood in the following ways:

- ❖ To implement the right techniques at the right moment effectively with minimum use of effort.
- ❖ To attain a desired result with certainty through the use of an acquired ability.
- ❖ To learn a performance-based activity for a specific target.

Examples of skills in sports are: serving in tennis, handspring in gymnastics and spike in volleyball.

Classification of Skill

Skills vary according to the nature of their respective games. Since there are numerous features of skills, classification is a very tricky task; they are more or less placed in a sequence. Listed below are some basic skills found in sports:

1. **Open Skill:** Skills that are random and prone to changes as per the circumstances are called

open skills. For example, the skill of a football player is determined by the speed and position of other players in the field.

2. **Closed Skill:** Skills that are within the control of the players and independent of the opponent's actions are classified as closed skills. They are used in a sporting environment where a player is aware of all possible moves and their outcomes. For example, free kicks in football.
3. **Simple Skill:** A simple skill does not require a lot of physical effort or strategies of coordination and decision-making. It can be learned and performed with greater ease than most skills. For example, straight jump and flick service in badminton.
4. **Complex Skill:** Unlike simple skills, complex skills need intense physical involvement, coordination, decision-making abilities and will come with a lot of pressure and possibility of injuries. For example, handspring in gymnastics.
5. **Gross Skill:** Gross skills can be identified by their use of large (though not necessarily precise) muscle movements, such as jumping, jogging, brisk walking, etc.
6. **Fine Skill:** A fine skill is complicated and accurate in movement. It uses small muscle groups and depends on both mental sharpness and physical activity.
7. **Discrete Skill:** It is a short skill with a definite ending and beginning. Example: shooting a gun, penalty flick in hockey, hitting a cricket ball, etc.
8. **Serial Skill:** It is a skill in which a series of discrete skills combine to form a complex movement, for instance, diving routine, gymnastics, etc.
9. **Continuous Skill:** A skill without a well-defined ending and beginning, such as cycling, running, swimming, etc.
10. **Individual Skill:** Skills performed in isolation are called individual skills, for example, long jump, high jump, hammer throw, etc.
11. **Coactive Skill:** A coactive skill is undertaken at the same time as undertaken by other opponents, but without directly confronting them. Examples include sprinting, swimming, cycling, etc.

12. Interactive Skill: Unlike coactive skills, interactive skills involve direct confrontation. Examples are tennis, table tennis, football, basketball, badminton, etc.

Meaning of Technique

Technique is the manner of applying a skill in a game setting. For example, the techniques involved in serving in badminton are high serve and flick serve. In a training schedule, techniques are taught before skills, as skills are executed with planning during the progression of the game.

Experts have defined technique as:

“The most rational and effective form to perform exercises.” – Ozolín

“The ideal model of a movement relative to a specific sport activity.” – Grosser

Clearly, technique will vary according to the type of sport. For strength-based sports such as weightlifting, the goal of a technique is to ensure production of a strong and focused impulse at the moment of implementation, whereas in opponent-based sports like hockey and soccer, technique teaches ways to solve variable moves and situations.

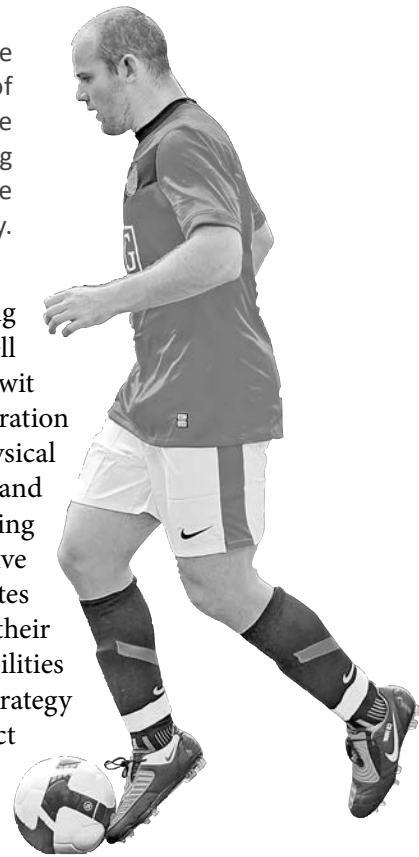
Teaching technique should be a scientific and economical method with a linear design. Albert Bandura in his book *Social Learning Theory* (1977) suggested a structure with decreasing priority as follows:

1. Mastery of movements
2. A good modelling experience
3. Verbal motivation
4. Physical stimulation and readiness

Tactics

Tactics refer to the skills necessary in any game to enable a player or team to utilise their talents and abilities to their fullest advantage. It encompasses both tactical actions and other measures taken before or during the competition to ensure successful participation. Tactics are defined as actions and strategies intended to achieve an overarching objective, which, in sports, is primarily to win. It involves the intelligent and creative

Figure 10.6 During practice sessions, repetitions of the skill or technique eventually lead to being able to perform it more accurately and efficiently.



application of skills during the competition, as well as methods used to outwit opponents. Tactical preparation involves organised physical exercises, mental drills, and modeling aimed at inspiring cognitive and competitive tactics. It enables athletes to make the best use of their motor and technical abilities during competitions. Strategy and tactics are distinct concepts; strategy is the overall plan for successful participation, while tactics refer to the actual realisation of strategy in practice. Factors that affect tactics include the opposition, including their strengths and weaknesses, players available for selection, the significance of the game or match, and possibly even the weather.

Strategies

Strategy involves setting goals and creating a plan to achieve them. This may include aiming to win a season or match and implementing strategies to accomplish this, such as developing an athlete's power, enhancing friendship, and selecting suitable players. It can be defined as a plan of action intended to achieve a long-term or overall objective. Strategy often necessitates a SWOT analysis, which involves analysing the team's strengths, weaknesses, opportunities, and threats to identify the best approach for winning.

Strategising can improve team synchronisation by aligning each member with the same end goal, enhancing morale and motivation. With a well-formulated strategy, each player becomes more aware of their individual objectives and place in the team, resulting in improved performance. Football is an example of a sport that requires complex strategies and tactics, with each team



Figure 10.7 Offensive strategy in football is about taking the initiative, creating opportunities and scoring goals, while defensive strategy is about preventing the opposition from scoring and minimising their chances of success.

devising a game plan consisting of hundreds of diagrammed plays and strategies for various pre-determined situations. These strategies are adjusted

during the game and halftime to adapt to the other team's strategies, with the effectiveness of these adjustments determining the outcome of the game.

EXERCISES



A. Objective Type/Multiple-Choice Questions

I. Multiple-Choice Questions:

- Which method of warming-up is meant to improve the flexibility of muscles?
 - Jogging
 - Stretching**
 - Wind sprints
 - Striding
- Warming-up is necessary for preparing the body
 - physically
 - mentally
 - emotionally
 - Only (a) and (b)**
- A lawn tennis player is very good at her service. Which of these types of skills would she be said to possess in relation to her service?
 - Coactive skill
 - Continuous skill
 - Individual skill
 - Discrete skill**
- Handspring in gymnastics is an example of
 - tactics
 - technique
 - skill**
 - all of these
- defined technique as "The most rational and effective form to perform exercises."
 - Grosser
 - Ozolin**
 - Jersild
 - Sadler
- What is the primary objective of tactics in sports?
 - To achieve a long-term goal
 - To win the competition**
 - To enhance the skills of the players
 - To develop a team's morale
- What is the difference between strategy and tactics?
 - Strategy involves mental drills, while tactics involve physical exercises.
 - Strategy is the overall plan, while tactics refer to the actual realisation of strategy in practice.**
 - Strategy is a short-term objective, while tactics are a long-term objective.
 - Strategy is individual-focused, while tactics are team-focused.

II. Assertion-Reason Type Questions:

CBQ

Given below are the two statements labelled Assertion (A) and Reason (R).

A: Warming-up is an intricate part of any training or sports.

R: It ensures the efficiency of an activity by preparing the body physically, mentally and psychologically.

In the context of the two statements given above, which one of the following is correct?

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (b) Both (A) and (R) are true but (R) is not the correct explanation of (A).
- (c) (A) is true, but (R) is false.
- (d) (A) is false, but (R) is true.

III. Picture-Based Questions:

CBQ

Identify the following activities and classify on the basis of skills:

1.



2.



3.



4.



B. Very Short Answer Type Questions

1. Define the term skill.
2. What is the meaning of technique?
3. What do you understand by the term 'style'?
4. Make a list of skills found in sports.
5. What do you mean by limbering down?
6. What are the two types of warming-up?
7. Write a short note on passive warming-up.
8. Write a precise note on active warming-up.
9. Describe the principle of warm-up and cool down.
10. Make a list of the guiding principles of warming-up.

C. Short Answer Type-I Questions

1. What does a SWOT analysis involve in sports strategy?
2. Why is warming-up important? Give five points.
3. Differentiate between passive warming-up and active warming-up.
4. Give two examples of stretches used for limbering down.
5. What is the aim of tactical preparation in sports?

D. Short Answer Type-II Questions

1. Discuss the concept of warming-up and its types.
2. Describe the methods of warming-up that you have learned.
3. Enumerate and explain the guiding principles of warming-up.
4. Write an essay on the classification of skills.
5. How does strategising improve team synchronisation?
6. What factors can affect tactics in sports?

E. Long Answer Type Questions

1. Discuss the importance of warming-up in sports.
2. What are the physiological bases of warming-up?
3. Discuss the importance of limbering down in sports.
4. What are the key differences between tactics and strategy in sports, and how can they be effectively utilised together to achieve success?

F. Value-Based Question

Rasika was participating in 'Run for Health' organised by her society. She was very excited as this was the first time she was taking part in such an event. Before going for run, Mr Verma told her about the importance of warming-up before doing any physical activity. Mr Verma told her about the general methods of warming-up, and that warm-up prepares the body for exercise and gradually increases the heart rate and blood circulation which loosens the joints, increases blood flow and prevents injuries. He advised her to warm-up before running. Rasika wholeheartedly followed the instructions of Mr Verma.

Answer the following questions based on the above passage:

1. What do you understand by the term warming-up?
2. What are the general methods of warming-up?
3. What are values shown by Rasika while participating in 'Run for Health'?